SmartWay DrayFLEET
TRUCK DRAYAGE ENVIRONMENT AND ENERGY MODEL

Version 1.0F User's Guide

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Prepared for:

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1.0 System Requirements, Installation, and Set-Up

1.1 Introduction

The objective of the DrayFLEET emissions and activity model is to accurately depict drayage activity in terms of VMT, emissions, cost, and throughput, and reliably reflect the impact of changing management practices, terminal operations, and cargo volume. Drayage of marine containers is now widely recognized as a critical emissions, congestion, and capacity issue for major container ports and rail intermodal terminals. Ports, technologists, and local planning agencies are struggling to reduce emissions, reduce congestion, and increase productivity so that growing cargo flows can coexist with port and terminal area communities.

The DrayFLEET model is activity based, not statistical, and directly reflects activity changes in response to new patterns and requirements. The model attempts to capture all container drayage movements within the port system: loaded and empty containers on chassis, bare chassis, and bobtail (tractor only) moves.

In simplest terms, the model allows users to input data values typical of their port or terminal (such as annual TEU or distance to major customers) to create a base case activity and emissions estimate. The user can then make further input choices to create "what if" scenarios.

Note: Variable and output values used as examples in this user's guide may differ slightly from the current model version.

1.2 System Requirements

DrayFLEET was created in Microsoft Excel 2003 SP1. The nominal system requirements for Excel 2003 are:

Computer: Personal computer with an Intel Pentium 2333-MHz or faster processor (Pentium III recommended)

Memory: 128 megabytes (MB) of RAM or greater

Hard Disk: 150 MB of available hard-disk space (to install Excel 2003)

Drive: CD-ROM or DVD drive

Display: Super VGA (800x600) or higher resolution monitor

Operating System: Microsoft Windows 2000 with Service Pack 3 (SP3), Windows XP, or later

The model itself occupies approximately 10 MB. Most users tend to save multiple copies reflecting multiple scenarios, so extensive model use may require up to 100 MB of hard disk space.

1.3 Installation

No special installation steps are required.

The model may be copied directly from the source CD or download site to a designated folder on the computer.

The model is distributed as a "read only" file to prevent accidental changes to default values, equations, or cell references. The model may be left as "read only" if the user prints out the results of each scenario. If the user wants to preserve scenario inputs or alter default values the easiest method is to create a new model copy without "read only" properties. To change the "read only" status of a copy, open the folder containing the copy, right click on the copy file name , and choose "Properties" from the menu. "Read only" status is shown on the "General" tab at the bottom.

1.4 Model Set-Up

DrayFLEET is distributed as a generic model for a hypothetical container port handling 2,000,000 annual TEU

There are three basic steps to setting up the model for application to a specific port or terminal:

1. Inputting your port or terminal's specific base case default values;
2. Resetting the default output values to create a port-specific base case; and
3. Creating scenarios as required.

2.0 Quick-Start Guide

2.1 Using the Primary Inputs & Outputs Worksheet

SmartWay DrayFLEET can be used for many purposes without delving into the details of container flows by working with the Primary Inputs & Outputs worksheet. Using this worksheet is also the best way to become familiar with DrayFLEET.

The Primary Inputs & Outputs worksheet is designed to be the main user interface, especially once the model has been set up with port-specific default values. This worksheet (shown in its entirety below) has five sections covering key input values, port or terminal management initiatives, activity outputs, emissions and cost outputs, and a note section to identify the model application and scenario.

SmartWay DrayFLEET Version 1.0 Primary Inputs & Outputs — DrayFLEET Version 1.0F of 07/30/2008

Primary Inputs	Default	Scenario
Port		
Calendar Year	2007	2007
Annual TEU	2,000,000	2,000,000
Average TEU per Container	1.75	1.75
Inbound Share	50%	50%
Inbound Empty Share	5%	5%
Outbound Empty Share	25%	25%
Rail Intermodal Share	25%	25%
Marine Terminals		
Average Inbound Gate Queue Minutes	15	15
Average Marine Terminal Min. per Transaction	30	30
Rail Terminals		
Weighted Average Miles from Port	5	5
Average Inbound Gate Queue Minutes	5	5
Average Rail Yard Min. per Transaction	15	15
Container Depots		
Weighted Average Miles from Port	2	2
Share of Empties Stored at Depots	10%	10%
Container Shippers/Receivers		
Weighted Average Miles from Port	25	25
Weighted Average Crosstown Trip Miles	10	10
Cost Factors		
Average Drayage Labor Cost per Hour	$ 12.00	$ 12.00
Average Diesel Fuel Price per Gallon	$ 4.00	$ 4.00

Initiative Inputs	Default	Scenario
Port/Terminal Initiatives		
Stacked Terminal (% stacked)	0%	0%
On-Dock Rail (% of rail on-dock)	0%	0%
Automated Gates (% of gate transactions)	0%	0%
Extended Gate Hours (% off-peak, 50% max)	0%	0%
Container Info System (% used)	0%	0%
Virtual Container Yard (% available)	0%	0%
Neutral Chassis Pool (% used)	0%	0%

Port	
Terminal(s)	
Scenario	
Date	

Activity Outputs	Default	Scenario	Change	% Change
Annual Activity				
Number of Drayage Trip Legs	3,826,235	3,826,235	0	0.0%
Drayage Trip Legs per Container	3.3	3.3	0.0	0.0%
Total Drayage VMT	68,413,994	68,413,994	0	0.0%
Drayage VMT per Container	59.9	59.9	0.0	0.0%
Fleet Required (FTE Tractors)	1,756	1,756	0	0.0%
Annual Duty Cycle Totals				
Idle Hours	1,957,060	1,957,060	0	0.0%
Creep Hours	1,089,182	1,089,182	0	0.0%
Transient Hours	597,318	597,318	0	0.0%
Cruise Hours	1,559,766	1,559,766	0	0.0%
Total Drayage Hours	5,203,327	5,203,327	0	0.0%
Drayage Hours per Container	4.6	4.6	0.0	0.0%

Emissions Outputs	Default	Scenario	Change	% Change
Pollutant (annual tons)				
HC	55	55	0.00	0.0%
CO	311	311	0.00	0.0%
NOx	1,154	1,154	0.00	0.0%
PM_{10}	38	38	0.00	0.0%
$PM_{2.5}$	32	32	0.00	0.0%
CO_2	145,037	145,037	0.00	0.0%
Fuel Use and Total Cost				
Fuel - Gallons	12,963,067	12,963,067	0.0	0.0%
Total Drayage Cost	$ 185,045,398	$ 185,045,398	$ -	0.0%
Drayage Cost per Container	$ 162	$ 162	$ -	0.0%

All of the input options are addressed in greater detail in subsequent sections of this user's guide.

2.2 Model Application and Scenario Information

The notes section at the upper right of the worksheet is provided as a convenience to the user and can be used to identify the default case, scenario, date, and other information associated with a DrayFLEET application. The entries here have no bearing on the activity or emissions estimates.

Port	Port of Interest
Terminal(s)	All
Scenario	Base Case
Date	Today

2.3 Key Input Values

The port features shown in the Primary Inputs section (below) usually have the greatest impact on the emissions estimates. At a minimum, the user should ascertain that the default cell values are suitable for the port or terminal in question. Defaults can be directly overridden by the user, or a scenario can be created and copied to the default cells. There is also an option for restoring the generic defaults if needed.

Primary Inputs	Default	Scenario
Port		
Calendar Year	2007	2007
Annual TEU	2,000,000	2,000,000
Average TEU per Container	1.75	1.75
Inbound Share	50%	50%
Inbound Empty Share	5%	5%
Outbound Empty Share	25%	25%
Rail Intermodal Share	25%	25%
Marine Terminals		
Average Inbound Gate Queue Minutes	15	15
Average Marine Terminal Min. per Transaction	30	30
Rail Terminals		
Weighted Average Miles from Port	5	5
Average Inbound Gate Queue Minutes	5	5
Average Rail Yard Min. per Transaction	15	15
Container Depots		
Weighted Average Miles from Port	2	2
Share of Empties Stored at Depots	10%	10%
Container Shippers/Receivers		
Weighted Average Miles from Port	25	25
Weighted Average Crosstown Trip Miles	10	10
Cost Factors		
Average Drayage Labor Cost per Hour	$ 12.00	$ 12.00
Average Diesel Fuel Price per Gallon	$ 4.00	$ 4.00

Initiative Inputs	Default	Scenario
Port/Terminal Initiatives		
Stacked Terminal (% stacked)	0%	0%
On-Dock Rail (% of rail on-dock)	0%	0%
Automated Gates (% of gate transactions)	0%	0%
Extended Gate Hours (% off-peak, 50% max)	0%	0%
Container Info System (% used)	0%	0%
Virtual Container Yard (% available)	0%	0%
Neutral Chassis Pool (% used)	0%	0%

The Scenario value cells are initially set equal to the Default cells, and will change as new default values are entered.

2.4 Initiative Inputs

The second section of the worksheet covers Initiative Inputs.

Initiative Inputs	Default	Scenario
Port/Terminal Initiatives		
Stacked Terminal (% stacked)	0%	0%
On-Dock Rail (% of rail on-dock)	0%	0%
Automated Gates (% of gate transactions)	0%	0%
Extended Gate Hours (% off-peak, 50% max)	0%	0%
Container Info System (% used)	0%	0%
Virtual Container Yard (% available)	0%	0%
Neutral Chassis Pool (% used)	0%	0%

The user has the option to "dial in" the extent to which these various port or terminal management and operations initiatives have been implemented by entering an appropriate percentage in the scenario column. The defaults are all zero. Since most ports have undertaken at least some of these measures, the default should be adjusted to match the base case.

The model can be used to analytically "back out" the estimated effects of a measure already taken by setting the default value to the current condition (50% stacked terminals, for example) and setting the scenario input to zero. The model will then be estimating the difference between activity and emissions with and without the initiative at issue.

2.5 Activity Outputs

The lower portion of the Primary Inputs and Outputs worksheet provides high-level comparisons of Default and Scenario drayage activity (below). Any change in the drayage activity will be mirrored in an emissions change.

Activity Outputs	Default	Scenario	Change	% Change
Annual Activity				
Number of Drayage Trip Legs	3,498,452	3,498,452	0	0.0%
Drayage Trip Legs per Container	3.1	3.1	0.0	0.0%
Total Drayage VMT	65,706,753	65,706,753	0	0.0%
Drayage VMT per Container	57.5	57.5	0.0	0.0%
Fleet Required (FTE Tractors)	1,224	1,224	0	0.0%
Annual Duty Cycle Totals				
Idle Hours	1,869,294	1,869,294	0	0.0%
Creep Hours	994,223	994,223	0	0.0%
Transient Hours	572,700	572,700	0	0.0%
Cruise Hours	1,506,026	1,506,026	0	0.0%
Total Drayage Hours	4,942,243	4,942,243	0	0.0%
Drayage Hours per Container	4.3	4.3	0.0	0.0%

The major activity measures are the number of trip legs (e.g. one-way trips between port facilities), the total Vehicle Miles Traveled (VMT), and the time spent in each of four operating modes (Idle, Creep, Transient, and Cruise). Averages per container are proved as a means of distinguishing the total impact of volume from the unit impact of operational changes. The

number of full-time equivalent (FTE) drayage tractors required is provided as an indication of changing fleet requirements.

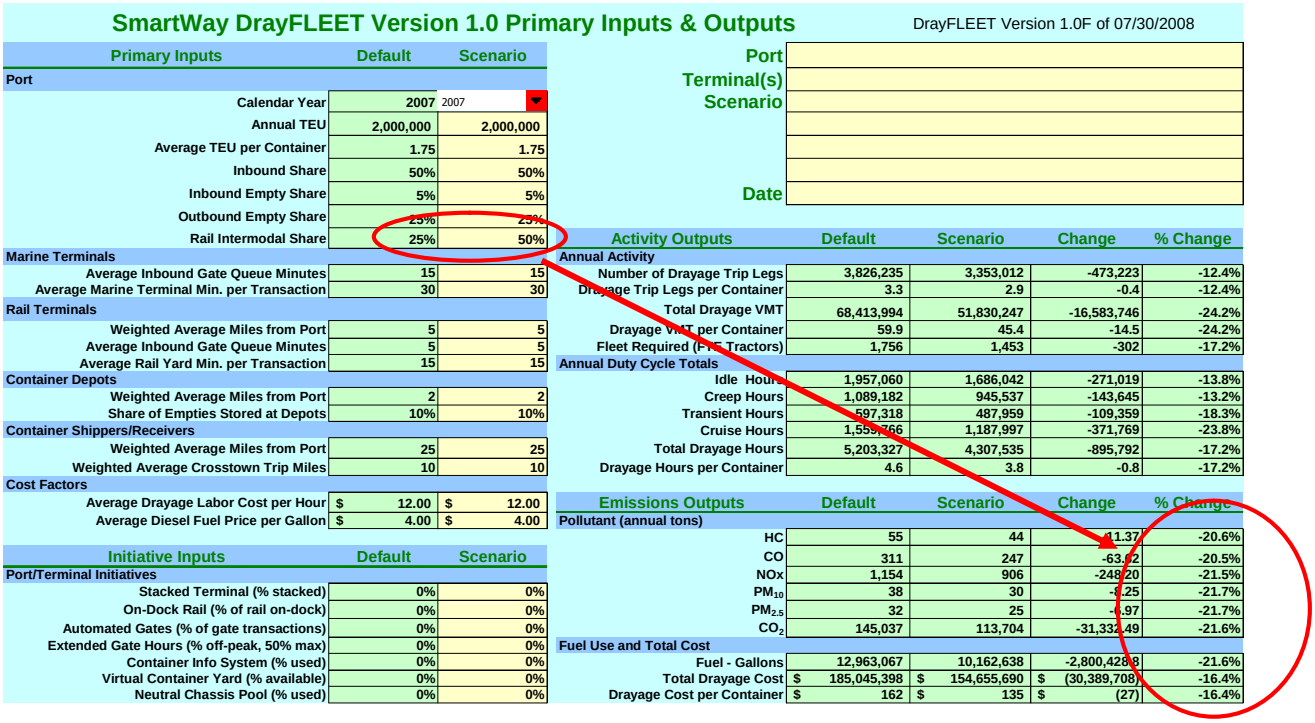
2.6 Emissions Outputs

The emissions outputs (below) give estimated annual tons for six different pollutants. As pollutant emissions mix varies with the duty cycle, the proportions will change under various scenarios. Fuel Use is listed under Emissions but it is also a major factor in the estimated cost. The total cost and cost per unit provides a sense of the tradeoffs required to achieve some emissions reductions, and the cost savings possible with productivity improvements.

Emissions Outputs	Default	Scenario	Change	% Change
Pollutant (annual tons)				
HC	53	53	0.00	0.0%
CO	298	298	0.00	0.0%
NOx	1,108	1,108	0.00	0.0%
PM_{10}	37	37	0.00	0.0%
$PM_{2.5}$	31	31	0.00	0.0%
CO_2	88,497	88,497	0	0.0%
Fuel Use and Total Cost				
Fuel - Gallons	7,909,626	7,909,626	0.0	0.0%
Total Drayage Cost	$ 159,451,797	$ 159,451,797	$ -	0.0%
Drayage Cost per Container	$ 140	$ 140	$ -	0.0%

2.7 Changing and Reversing Scenario Inputs

Individual scenario input values can be easily changed to observe the impact on model outputs using standard Excel features. For example, the graphic below shows a change from 25% rail intermodal (default) to a scenario with 50% rail intermodal, resulting in reduced emissions.



SmartWay DrayFLEET Version 1.0 Primary Inputs & Outputs — DrayFLEET Version 1.0F of 07/30/2008

Primary Inputs	Default	Scenario
Port		
Calendar Year	2007	2007
Annual TEU	2,000,000	2,000,000
Average TEU per Container	1.75	1.75
Inbound Share	50%	50%
Inbound Empty Share	5%	5%
Outbound Empty Share	25%	25%
Rail Intermodal Share	25%	50%
Marine Terminals		
Average Inbound Gate Queue Minutes	15	15
Average Marine Terminal Min. per Transaction	30	30
Rail Terminals		
Weighted Average Miles from Port	5	5
Average Inbound Gate Queue Minutes	5	5
Average Rail Yard Min. per Transaction	15	15
Container Depots		
Weighted Average Miles from Port	2	2
Share of Empties Stored at Depots	10%	10%
Container Shippers/Receivers		
Weighted Average Miles from Port	25	25
Weighted Average Crosstown Trip Miles	10	10
Cost Factors		
Average Drayage Labor Cost per Hour	$ 12.00	$ 12.00
Average Diesel Fuel Price per Gallon	$ 4.00	$ 4.00

Initiative Inputs	Default	Scenario
Port/Terminal Initiatives		
Stacked Terminal (% stacked)	0%	0%
On-Dock Rail (% of rail on-dock)	0%	0%
Automated Gates (% of gate transactions)	0%	0%
Extended Gate Hours (% off-peak, 50% max)	0%	0%
Container Info System (% used)	0%	0%
Virtual Container Yard (% available)	0%	0%
Neutral Chassis Pool (% used)	0%	0%

Port	
Terminal(s)	
Scenario	
Date	

Activity Outputs	Default	Scenario	Change	% Change
Annual Activity				
Number of Drayage Trip Legs	3,826,235	3,353,012	-473,223	-12.4%
Drayage Trip Legs per Container	3.3	2.9	-0.4	-12.4%
Total Drayage VMT	68,413,994	51,830,247	-16,583,746	-24.2%
Drayage VMT per Container	59.9	45.4	-14.5	-24.2%
Fleet Required (FTE Tractors)	1,756	1,453	-302	-17.2%
Annual Duty Cycle Totals				
Idle Hours	1,957,060	1,686,042	-271,019	-13.8%
Creep Hours	1,089,182	945,537	-143,645	-13.2%
Transient Hours	597,318	487,959	-109,359	-18.3%
Cruise Hours	1,559,766	1,187,997	-371,769	-23.8%
Total Drayage Hours	5,203,327	4,307,535	-895,792	-17.2%
Drayage Hours per Container	4.6	3.8	-0.8	-17.2%

Emissions Outputs	Default	Scenario	Change	% Change
Pollutant (annual tons)				
HC	55	44	-11.37	-20.6%
CO	311	247	-63.62	-20.5%
NOx	1,154	906	-248.20	-21.5%
PM_{10}	38	30	-8.25	-21.7%
$PM_{2.5}$	32	25	-7.97	-21.7%
CO_2	145,037	113,704	-31,332.49	-21.6%
Fuel Use and Total Cost				
Fuel - Gallons	12,963,067	10,162,638	-2,800,428.8	-21.6%
Total Drayage Cost	$ 185,045,398	$ 154,655,690	$ (30,389,708)	-16.4%
Drayage Cost per Container	$ 162	$ 135	$ (27)	-16.4%

To reverse the changes use Excel's Undo Command, either by choosing "Undo" from the drop-down menu under "Edit" on the Excel toolbar, or via the CTRL+Z keyboard shortcut. Excel can track and undo up to 15 changes of this type, although other activity in the interim may prevent undoing the changes. To restore the Base Case value, set the Scenario cell equal to the corresponding Default cell.

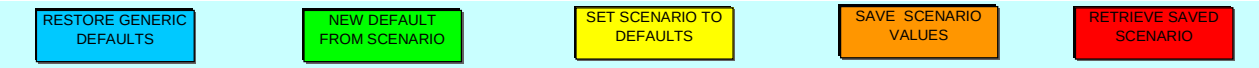
DrayFLEET Version 1.0 will store one scenario internally, using the macro buttons on the Primary Inputs & Outputs worksheet

There are multiple other ways to save a copy of the Primary Inputs & Outputs worksheet as a record of scenario inputs and outputs.

- Print a hard copy[1] of the worksheet.
- Use Paste Special in Word to insert an image of the worksheet into a Word document as a Picture[2].
- Use Adobe Acrobat®, Scansoft PDF Create!®, or other software to save an image of the worksheet as a PDF file.
- Save a copy of the entire DrayFLEET model with an appropriate filename.

2.8 Using DrayFLEET Macros to Manage Inputs

There are five macro buttons at the bottom of the Primary Inputs and Outputs worksheet (below).



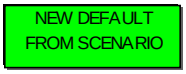
These buttons can be used to manage default and scenario inputs on the Primary Inputs and Outputs and Secondary Inputs worksheets.

In DrayFLEET Version 1.0 these macros do not affect inputs on the Drayage Fleet Inputs, Cost and Capacity, or individual activity tally worksheets. Those inputs must still be managed manually in this version.

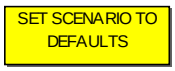
Restore Generic Defaults. This macro, activated by clicking the button, will replace the current default values on the main input pages with the original generic defaults stored in the model. Any customized default values will be overwritten. To preserve a customized base case, either save a separate version of the model (recommended) or do not use this button.

[1] This will not, however, show any changes that have been made on other model worksheets, such as the detailed inputs on the drayage activity sheets.

[2] Do not attempt to paste the worksheet as a Microsoft Excel Object.



New Default from Scenario. The easiest way to create a customized default or base case model is to create a customized scenario and then, once the user is satisfied, click this button to reset the default values to the new scenario. The Restore Generic Defaults button will reverse this process.



Set Scenario to Defaults. As the model comes the scenario values are set equal to the default values. Inputting new scenario values will override these formulas. Use this button to reset the scenario values equal to the *current* defaults. To set the scenario values to the generic defaults, use the Restore Generic Defaults button first.

Save Scenario Values. DrayFLEET Version 1.0 will save one set of scenario inputs internally. Use this button to store those values in the model for reuse later. *Note that this button does not affect the scenario calendar year, which must be reset manually.*

Retrieve Saved Scenario. This button will replace the Scenario inputs on the Primary Inputs and Outputs and Secondary Inputs worksheets with the stored scenario values. The defaults can be set to the stored scenario values by using this button first, then using the New Default from Scenario button.

DrayFLEET Version 1.0 does not have safeguards against accidental use of these buttons and resulting loss of data. The user is urged to use them cautiously.

3.0 Inputting Default Values

3.1 Creating a Base Case

With one the generic port versions as a starting point, the next step is to input new default values as necessary to create a base case for the terminal or port being modeled. For example, you will want to input your annual TEU numbers instead of the default values. The default value should be replaced whenever more accurate local estimates are available.

It is recommended that the user start by saving a working copy of the model with a new file name such as "Myport Drayage Model.xls".

The Secondary Inputs worksheet, discussed in a later section, has additional Marine Terminal options.

3.2 Primary Inputs

Setting up a base case for the port or terminal being modeled requires inputting new default values where local conditions differ from the initial model version chosen. The Primary Inputs & Outputs spreadsheet is used to assemble the basic model inputs, as indicated in the Quick Start section. For each of the Primary Inputs there is a Default value and a Scenario value. The model uses the Default value unless it is superseded by a different user entry in the Scenario columns.

SmartWay DrayFLEET Version 1.0 Primary Inputs & Outputs — DrayFLEET Version 1.0F of 07/30/2008

Primary Inputs	Default	Scenario
Port		
Calendar Year	2007	2007
Annual TEU	2,000,000	2,000,000
Average TEU per Container	1.75	1.75
Inbound Share	50%	50%
Inbound Empty Share	5%	5%
Outbound Empty Share	25%	25%
Rail Intermodal Share	25%	25%
Marine Terminals		
Average Inbound Gate Queue Minutes	15	15
Average Marine Terminal Min. per Transaction	30	30
Rail Terminals		
Weighted Average Miles from Port	5	5
Average Inbound Gate Queue Minutes	5	5
Average Rail Yard Min. per Transaction	15	15
Container Depots		
Weighted Average Miles from Port	2	2
Share of Empties Stored at Depots	10%	10%
Container Shippers/Receivers		
Weighted Average Miles from Port	25	25
Weighted Average Crosstown Trip Miles	10	10
Cost Factors		
Average Drayage Labor Cost per Hour	$ 12.00	$ 12.00
Average Diesel Fuel Price per Gallon	$ 4.00	$ 4.00

Initiative Inputs	Default	Scenario
Port/Terminal Initiatives		
Stacked Terminal (% stacked)	0%	0%
On-Dock Rail (% of rail on-dock)	0%	0%
Automated Gates (% of gate transactions)	0%	0%
Extended Gate Hours (% off-peak, 50% max)	0%	0%
Container Info System (% used)	0%	0%
Virtual Container Yard (% available)	0%	0%
Neutral Chassis Pool (% used)	0%	0%

Port	
Terminal(s)	
Scenario	
Date	

Activity Outputs	Default	Scenario	Change	% Change
Annual Activity				
Number of Drayage Trip Legs	3,826,235	3,826,235	0	0.0%
Drayage Trip Legs per Container	3.3	3.3	0.0	0.0%
Total Drayage VMT	68,413,994	68,413,994	0	0.0%
Drayage VMT per Container	59.9	59.9	0.0	0.0%
Fleet Required (FTE Tractors)	1,756	1,756	0	0.0%
Annual Duty Cycle Totals				
Idle Hours	1,957,060	1,957,060	0	0.0%
Creep Hours	1,089,182	1,089,182	0	0.0%
Transient Hours	597,318	597,318	0	0.0%
Cruise Hours	1,559,766	1,559,766	0	0.0%
Total Drayage Hours	5,203,327	5,203,327	0	0.0%
Drayage Hours per Container	4.6	4.6	0.0	0.0%

Emissions Outputs	Default	Scenario	Change	% Change
Pollutant (annual tons)				
HC	55	55	0.00	0.0%
CO	311	311	0.00	0.0%
NOx	1,154	1,154	0.00	0.0%
PM_{10}	38	38	0.00	0.0%
$PM_{2.5}$	32	32	0.00	0.0%
CO_2	145,037	145,037	0.00	0.0%
Fuel Use and Total Cost				
Fuel - Gallons	12,963,067	12,963,067	0.0	0.0%
Total Drayage Cost	$ 185,045,398	$ 185,045,398	$ -	0.0%
Drayage Cost per Container	$ 162	$ 162	$ -	0.0%

The Scenario value cells are initially set equal to the Default cells, and will change as new default values are entered.

The key port and terminal inputs specify the overall volume and pattern of container movements. The generic model version offers the user convenient starting points to avoid having to input every variable.

3.3 Primary Port Inputs

Primary Inputs	Default	Scenario
Port		
Calendar Year	2007	2007
Annual TEU	2,000,000	2,000,000
Average TEU per Container	1.75	1.75
Inbound Share	50%	50%
Inbound Empty Share	5%	5%
Outbound Empty Share	25%	25%
Rail Intermodal Share	25%	25%

Calendar Year – Default 2007. Choose the calendar year for the analysis using the drop-down menu. Users can estimate historic emissions, for purposes of developing a baseline, current emissions, or future emissions.

Annual TEU – Default 2,000,000 TEU. Enter the total annual Twenty-foot Equivalent Units (TEU) handled by the port or terminal in question.

Average TEU/Container – Default 1.75. Enter the appropriate factor to convert the TEU data to an equivalent container count. The value is usually between 1.5 (equivalent to half 20' and half 40') and 1.9 (equivalent to a predominance of 40' and 45' containers).

Inbound Share – Default 50%. Enter the percentage of TEU or containers moving inbound from vessel to port or terminal, whether loaded or empty, import or domestic cargo. The inbound share should be based on TEU or container count, not tonnage or revenue.

Inbound Empty % – Default 5%. Enter the percentage of import TEU or containers that arrive empty. This factor is usually small, but is included for comprehensiveness.

Outbound Empty % – Default 25%. Enter the percentage of outbound TEU or containers that depart empty. This factor typically ranges from a low of near 10% at ports with nearly balanced trade to a high of around 60%-70% at very imbalanced ports.

Rail Intermodal Share – Default 25%. Enter the total percentage of on-dock and off-dock rail intermodal movement of port containers (in % of TEU or containers, not tonnage), both loaded and empty. This percentage should not include cargo transloaded to domestic containers or trailers, or domestic freight moved in international containers. The split between on-dock and off-dock rail is entered under Initiative Inputs.

3.4 Primary Marine Terminal Inputs

Marine Terminals		
Average Inbound Gate Queue Minutes	15	15
Average Marine Terminal Min. per Transaction	30	30

Average Inbound Gate Queue Minutes – Default 15 minutes. Enter the average minutes that drayage drivers spend waiting in queues outside terminal gates. Typical values could range from 5 to 60 minutes. The time spent at the gate and the time spent transacting business inside the terminal are separate variables.

Average Container Yard Minutes per Transaction – Default 30 minutes. Enter the average minutes required inside the marine terminal container yard to complete a single transaction. Such transactions include picking up or draying a loaded or empty container or chassis, locating or draying a bare chassis, switching containers between chassis (a "chassis flip"), or live lifts of containers on or off a chassis. The model default uses the same time for each of these transactions, with 30 minutes being a common rule of thumb, except for longer times for chassis flips. The user can specify different times for individual activities on the Marine Terminal Spreadsheet if desired.

3.5 Primary Rail Terminal Inputs

The primary rail terminal inputs characterize movements at off-dock rail intermodal facilities.

Rail Terminals		
Weighted Average Miles from Port	5	5
Average Inbound Gate Queue Minutes	5	5
Average Rail Yard Min. per Transaction	15	15

Weighted Average Miles from Marine Terminal – Default 5 miles. Where there is only one marine terminal and one off-dock rail terminal, enter the distance between them. In a port complex system with multiple off-dock rail terminals and marine terminals, enter a weighted average distance.

Average Inbound Gate Queue Minutes – Default 5 minutes. Enter the average time draymen spend waiting to enter the inbound gates at off-dock rail terminals. Time spent at the gate and in the terminal are separate factors.

Average Rail Yard Minutes per Transaction – Default 15 minutes. Enter the average time required in the rail terminal yard (after passing through the gate) for a single transaction: e.g. picking up or dropping off a loaded container, empty container, or bare chassis. The transaction time for rail terminals is typically slower than for marine terminals.

3.6 Primary Container Depot Inputs

Container depots are off-terminal storage and maintenance facilities for containers (and sometimes chassis). The use of off-terminal storage varies widely – highest at ports with large

accumulations of empty containers and limited on-terminal capacity, lowest where loaded container flows balance and terminals have more space.

Container Depots		
Weighted Average Miles from Port	2	2
Share of Empties Stored at Depots	10%	10%

Weighted Average Miles from Marine Terminal – Default 2 miles. Where there is just one marine terminal and one depot, enter the distance between them. Where there are multiple terminals and multiple depots the input value should be the weighted average

Share of Empties Stored at Depots – Default 10%. Enter the percentage of empty containers that are either returned to a leasing company depot ("off-hired") or stored at a depot for other reasons.

3.7 Primary Shipper/Receivers Inputs

At most ports local and regional shipper (exporter) and receiver (consignee, importer) facilities are the most common end points for port drayage trips.

Container Shippers/Receivers		
Weighted Average Miles from Port	25	25
Weighted Average Crosstown Trip Miles	10	10

Weighted Average Miles from Port – Default 25 miles. Enter the average distance traveled to local and regional shippers and consignees. Ideally, the input value should be an average of distances weighted by the volume of containers traveling each distance. Users are encouraged to consult with their states or local air quality planners to determine the appropriate geographic area to assess drayage emissions, which may exclude parts of the longer trips.

Weighted Average Crosstown Miles – Default 10 miles. Enter the average distance between shipper/receiver locations and container depots or rail terminals. This input should ideally be the weighted average of all crosstown trips.

3.8 Drayage Cost Inputs

There are two drayage cost inputs in the Primary Inputs section; others are on the Cost & Capacity worksheet.

Cost Factors				
Average Drayage Labor Cost per Hour	$	12.00	$	12.00
Average Diesel Fuel Price per Gallon	$	4.00	$	4.00

Average Labor Cost per Hour – Default $12.00. Enter the average hourly cost of drayage labor (truck drivers). For owner-operators, this would be the average hourly earnings after expenses. For employee drivers, this would be wages plus benefits.

Average Fuel Price – Default $4.00. Enter the average price per gallon for diesel fuel.

3.9 Initiative Inputs

This section of the input worksheet allows users to specify the extent to which various port and terminal management initiatives have been implemented. **Users are encouraged to review the DrayFLEET model technical report for more detail on these management initiatives**.

Initiative Inputs	Default	Scenario
Port/Terminal Initiatives		
Stacked Terminal (% stacked)	0%	0%
On-Dock Rail (% of rail on-dock)	0%	0%
Automated Gates (% of gate transactions)	0%	0%
Extended Gate Hours (% off-peak, 50% max)	0%	0%
Container Info System (% used)	0%	0%
Virtual Container Yard (% available)	0%	0%
Neutral Chassis Pool (% used)	0%	0%

Stacked Terminal – Default 0%. Enter the percentage of containers (loaded and empty) that are typically stacked at the marine terminal(s) rather than parked on chassis. Because a stacked terminals requires drayman to make additional in-terminal moves to pick up and drop bare chassis, increasing the percentage of stacking will increase total drayage activity and emissions unless accompanied by a neutral chassis pool (see below) to rationalize the chassis supply.

On-Dock Rail – Default 0%. Enter the percentage of rail intermodal containers or TEU that are transferred at on-dock rail facilities rather than at off-dock or near-dock facilities. The model assumes no truck drayage at on-dock rail facilities.

Automated Gates – Default 0%. Enter the percentage of container or TEU that are handled at automated terminal gates (e.g. via OCR, swipe card, RFID, or other technology that reduces time at the gates). Alternately, the user can enter the percentage of gates that are automated, assuming that each gate handles the same percentage of containers.

Extended Gate Hours – Default 0%. Enter the percentage of containers or TEU that pass through terminal gates in off-peak hours, up to a maximum of 50%.

Container Information System – Default 0%. Enter the percentage of containers or TEU whose movement or handing is covered by a port or terminal information system accessible to draymen (e.g. eModal, VoyagerTrack). This value is usually less than 100% because some drayage firms or infrequent truckers do not use such systems.

Virtual Container Yard – Default 0%. Enter the percentage of containers or TEU for which a Virtual Container Yard (VCY) or other container status and interchange system is available (even if the container in question is not listed as available). This value is usually less than 100% because some drayage firms do not use available systems. Note that a VCY can make very little difference if crosstown relocation distances between importers and exporters are long (comparable to shipper-to-port distances) or if a very few container are being reused to begin with (Default 1%, see Secondary Inputs).

Neutral Chassis Pool – Default 0%. Enter the percentage of containers or TEU handled at terminals with neutral chassis pools (or alternately, the percentage of containers or TEU mounted on neutral pool chassis). Use of a neutral chassis pool will change the impact of a stacked terminal from negative (more activity and emissions) to positive (less activity and reduced emissions).

3.10 Secondary Inputs

The Secondary Inputs worksheet (below) provides an opportunity to fine-tune several aspects of port and terminal container flow and drayage operations. The model contains typical or generic default values for all these inputs. Wherever data is available to set these parameters to port-specific values, the accuracy of the DrayFLEET model will be improved.

SmartWay DrayFLEET Version 1.0 Secondary Inputs & Outputs

This worksheet allows the user to specify drayage activity parameters in greater detail where information is available.

	Default	Scenario
Port Operations		
Barge/Transshipment Share	0%	**0%**
Inter-Terminal Dray Share	1%	**1%**
Marine Terminal Operations		
% of bobtails using bypass gate	0%	**0%**
% bare chassis at gates	10%	**10%**
% bobtail tractors at gates	30%	**30%**
Rail Terminal Operations		
Inbound/Import % empty via rail	5%	**5%**
Outbound/Export % empty via rail	25%	**25%**
% of bobtails using bypass gate	0%	**0%**
% live lift	0%	**0%**
% of rail empties returned to depots	1%	**1%**
Container Depot Operations		
% bobtail moves	20%	**20%**
% of depot empties sent to rail	1%	**1%**

	Default	Scenario
Shipper/Receiver Operations		
% bobtail moves	20%	**20%**
% of drivers waiting for load/unload	0%	**0%**
% of empties supplied from depots	1%	**1%**
% of empties returned to depots	1%	**1%**
% of empties reused for loads	1%	**1%**
% of empties supplied from rail	1%	**1%**
% of empties returned to rail	1%	**1%**
Other Port Truck Operations		
Wtd. Avg. Miles from Port	25	**25**
Export Tons Trucked	-	**-**
Avg. Export Tons per truck	20	**20**
Import Tons Trucked	-	**-**
Avg. Import Tons per truck	20	**20**
% bobtail moves	20%	**20%**

3.10.1 Port Operations

Barge/Transshipment Share – Default 0%. If containers are transferred to or from barges at the facility or if there is transshipment performed, enter the percentage of TEU or containers affected. If the barge or vessel transfers involve drayage to another terminal, those trips should be considered part of inter-terminal drayage.

Inter-Terminal Dray Share – Default 1%. For a port analysis, enter the percentage of containers that are drayed between port terminals. For a single terminal analysis, enter zero.

3.10.2 Marine Terminal Operations

% of Bobtails using Bypass Gate – Default 0%. Many marine terminals have a bypass gate for bobtail trips to reduce congestion at the main gates. Enter the percentage of bobtail trips using such bypass gates.

% Bare Chassis at Gates – Default 10%. If available, enter the port-specific share of bare chassis passing through marine terminal gates as a percentage of total gate movements.

% of Bobtail Tractors at Gates – Default 30%. If available, enter the port-specific percentage of bobtail trips at marine terminal gates as a percentage of total gate movements.

3.10.3 Rail Terminal Operations

Inbound/Import Empty % via Rail – Default 5%. If available, enter the percentage of empty containers on rail movements from the Port (remembering that the railroad will consider such movements *outbound*). This number is usually small.

Outbound/Export Empty % via Rail – Default 25%. If available, enter the percentage of empty containers on rail movements to the Port (remembering that the railroad will consider such movements *inbound*). This number is usually larger than the import number.

% of Bobtails using Bypass Gate – Default 0%. Many rail terminals have a bypass gate for bobtail trips to reduce congestion at the main gates. Enter the percentage of bobtail trips using such bypass gates.

% Live Lifts – Default 0%. The norm for rail terminals is for drayman to park containers on chassis for subsequent loading by the terminal operator, and to pick up parked containers on chassis that have been previously unloaded from trains. "Live lifts" occur when the drayman waits to have the container transferred from chassis to rail car (or vice versa).

% of Rail Empties Returned to Depots – Default 1%. Enter the percentage of empty containers that arrive at off-dock rail terminals and are drayed to off-dock container depots for storage rather than being drayed to the marine terminals.

3.10.4 Container Depot Operations

% of Bobtail Moves – Default 20%. If available, enter the percentage of bobtail trips at container depot gates as a percentage of total depot gate movements.

% of Depot Empties Sent to Rail – Default 1%. Enter the percentage of empty containers sent to rail intermodal terminals from off-dock container depots rather than being sent to marine terminals.

3.10.5 Shipper/Receiver Operations

% of Bobtail Moves – Default 20%. If available, enter the percentage of bobtail trips at shipper/receiver gates as a percentage of total shipper/receiver gate movements.

% of Drivers Waiting for Load/Unload – Default 0%. The norm for most shippers and receivers is for drayman to park loaded or empty containers on chassis for subsequent handling by the customer, and to pick up parked containers on chassis that are ready to go to marine terminals or elsewhere. These are generally referred to as "drop and pick" operations. "Stay with" trips occur when the drayman waits to have a loaded import container unloaded or an empty export container loaded. Where information on the prevalence of "stay with" waits is available, enter the appropriate percentage.

% of Empties Supplied from Depots – Default 1%. Enter the percentage of empty containers for export loads supplied from off-dock container depots rather than from marine terminals. This percentage can vary widely between ports.

% of Empties Returned to Depots – Default 1%. Enter the percentage of emptied import containers that are drayed to off-dock container depots rather than to the marine terminals. This percentage can vary widely between ports.

% of Empties Supplied from Rail – Default 1%. Enter the percentage of empty containers for export loads supplied from off-dock rail terminals rather than from marine terminals or depots. This percentage can vary widely between ports.

% of Empties Returned to Rail – Default 1%. Enter the percentage of emptied import containers that are drayed to off-dock rail intermodal terminals rather than to the marine terminals. This percentage can vary widely between ports.

% of Empties Reused for Loads – Default 1%. Enter the percentage of emptied import containers that are repositioned and used for an export load, either by the original drayman or by another firm. This percentage tends to be low, less than 5% at most ports. The VCY initiative input on the Primary Inputs and Outputs worksheet will double this value, but will have minimal impact if the opportunity to reuse empties is itself minimal.

3.10.6 Other Port Trucks

This section of the secondary inputs worksheet is provided to enable users to account for significant movements of port-related trucks handling commodities other than containerized cargo. These movements could include bulk or break-bulk cargoes.

Other Port Truck Operations		
Wtd. Avg. Miles from Port	25	**25**
Export Tons Trucked	-	**-**
Avg. Export Tons per truck	20	**20**
Import Tons Trucked	-	**-**
Avg. Import Tons per truck	20	**20**
% bobtail moves	20%	**20%**

Weighted Average Miles from Port – Default 25 miles. Enter the average distance other trucks travel to and from the Port. A weighted average would be ideal.

Export Tons Trucked – Default 0. Enter the annual short tons of export cargo moved to the port by truck. Do not include tonnage moving by rail.

Average Export Tons per Truck – Default 20 tons. Enter the average export cargo load per truck in short tons.

Import Tons Trucked – Default 0. Enter the annual short tons of import cargo moved from the port by truck. Do not include tonnage moving by rail.

Average Import Tons per Truck – Default 20 tons. Enter the average import cargo load per truck in short tons.

% Bobtail Moves – Default 20%. Enter the percentage of bobtail tractor moves in the Other Port Trucks activity. Note that only tractor-trailer operations will generate bobtail moves. Activity using straight trucks (such as conventional single-unit dump trucks or flatbed trucks delivering steel) will not generate bobtail moves.

3.11 Drayage Fleet Inputs

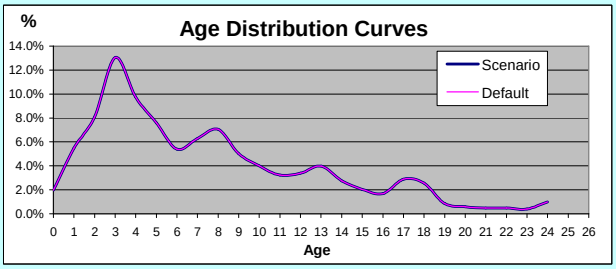
The drayage fleet inputs are on a separate worksheet and consist of a drayage fleet age distribution, as shown below.

SmartWay DrayFLEET Version 1.0 - Drayage Fleet Inputs

Values on this worksheet are not affected by reset macros

Fleet Age Distribution

Scenario: Same as Default			Default: US VIUS Default		
Age	#	%	Age	#	%
0	26	2.0%	0	26	2%
1	72	5.5%	1	72	5%
2	107	8.1%	2	107	8%
3	172	13.0%	3	172	13%
4	129	9.7%	4	129	10%
5	100	7.6%	5	100	8%
6	71	5.4%	6	71	5%
7	83	6.3%	7	83	6%
8	93	7.0%	8	93	7%
9	66	5.0%	9	66	5%
10	53	4.0%	10	53	4%
11	43	3.2%	11	43	3%
12	45	3.4%	12	45	3%
13	53	4.0%	13	53	4%
14	36	2.8%	14	36	3%
15	27	2.0%	15	27	2%
16	22	1.7%	16	22	2%
17	38	2.9%	17	38	3%
18	34	2.6%	18	34	3%
19	11	0.9%	19	11	1%
20	8	0.6%	20	8	1%
21	6	0.5%	21	6	0%
22	6	0.5%	22	6	0%
23	5	0.4%	23	5	0%
24	13	1.0%	24	13	1%
Total	1,320	100%	Total	1,320	100%



Drayage Fleet Technology and Strategy Inputs*

Technology Retrofits		
☐ Particulate Filter/Trap	% of eligible fleet retrofit	50%
☐ Oxidation Catalyst	% of eligible fleet retrofit	50%
☐ Flow-Through Filter	% of eligible fleet retrofit	50%
Idle Reduction		
☐ Idling Control Strategies	% reduction in idle	50%
Fuel Conservation		
☐ Single-Wide Tires	% of fleet	50%
☐ Automatic Tire Inflation	% of fleet	50%
☐ Tare Weight Reduction	% of fleet	50%
	lbs of weight saved	2,000
☐ Low Friction Engine Lubricant	% of fleet	50%
☐ Low Friction Drive Train Lubricant	% of fleet	50%
☐ Direct Drivetrain	% of fleet	50%
☐ Single Axle Drive (vs. Dual Axle)	% of fleet	50%
☐ Speed Management Policy (55 mph)	% of fleet	50%

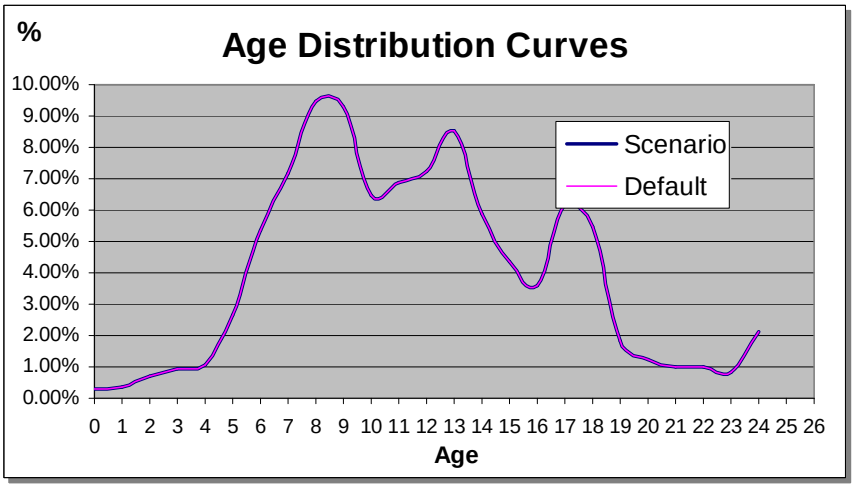
* Allow the model a few moments to react to changes in the check boxes.

Default. The Default Age Distribution Menu offers a choice between four pre-set age distributions shown below.

Age Years	LALB Default	Houston Default	US VIUS Default	MOBILE6.2 8b
0	0.3%	0.0%	2.0%	0.0%
1	0.4%	0.0%	5.5%	4.2%
2	0.7%	2.0%	8.1%	7.9%
3	0.9%	1.0%	13.0%	7.4%
4	1.1%	2.0%	9.7%	6.9%
5	2.6%	1.0%	7.6%	6.5%
6	5.3%	5.9%	5.4%	6.0%
7	7.2%	14.9%	6.3%	5.6%
8	9.5%	13.9%	7.0%	5.3%
9	9.3%	5.0%	5.0%	4.9%
10	6.5%	5.9%	4.0%	4.6%
11	6.9%	15.8%	3.2%	4.3%
12	7.2%	8.9%	3.4%	4.0%
13	8.5%	9.9%	4.0%	3.8%
14	5.9%	5.0%	2.8%	3.5%
15	4.4%	0.0%	2.0%	3.3%
16	3.6%	2.0%	1.7%	3.1%
17	6.2%	0.0%	2.9%	2.9%
18	5.5%	2.0%	2.6%	2.7%
19	1.8%	4.0%	0.9%	2.5%
20	1.3%	0.0%	0.6%	2.4%
21	1.0%	1.0%	0.5%	2.2%
22	1.0%	0.0%	0.5%	2.1%
23	0.8%	0.0%	0.4%	1.9%
24	2.1%	0.0%	1.0%	1.8%

Scenario. The Scenario menu offers two choices: a distribution equal to the default or a user-specified custom distribution (which must total 100%). Enter the number of trucks in each age group, and the model will calculate the percentages.

The chart to the right of the drop-down menus (below) compares the chosen Default and Scenario cases. This chart can be very useful in verifying the reasonableness of user-specified distributions.



3.12 Drayage Technology and Strategy Inputs

Drayage trucks can be retrofit with technologies to save fuel and reduce emissions. The DrayFLEET model accounts for the emission reductions from retrofitting drayage trucks with

exhaust after treatment, the impact that retrofits have has on fuel economy (both good and bad); and the emission reductions from strategies to improve fuel economy. Controls for modeling the effect of equipping or retrofitting portions of the drayage fleet with advanced emission control and fuel economy technologies are also on the Drayage Fleet Inputs worksheet as shown below.

Drayage Fleet Technology and Strategy Inputs*

Technology Retrofits		
☐ Particulate Filter/Trap	% of eligible fleet retrofit	50%
☐ Oxidation Catalyst	% of eligible fleet retrofit	50%
☐ Flow-Through Filter	% of eligible fleet retrofit	50%
Idle Reduction		
☐ Idling Control Strategies	% reduction in idle	50%
Fuel Conservation		
☐ Single-Wide Tires	% of fleet	50%
☐ Automatic Tire Inflation	% of fleet	50%
☐ Tare Weight Reduction	% of fleet	50%
	lbs of weight saved	2,000
☐ Low Friction Engine Lubricant	% of fleet	50%
☐ Low Friction Drive Train Lubricant	% of fleet	50%
☐ Direct Drivetrain	% of fleet	50%
☐ Single Axle Drive (vs. Dual Axle)	% of fleet	50%
☐ Speed Management Policy (55 mph)	% of fleet	50%

* Allow the model a few moments to react to changes in the check boxes.

Each strategy can be selected for analysis by activating the adjacent checkbox. Additionally, the user needs to specify the technology penetration rate (%) indicating the extent to which the chosen strategy or technology has been adopted. In a each case, the percentage applies to the portion of the fleet or duty cycle to which the strategy is applicable, Reflashing, for example, is only applicable to a narrow range of tractors in the 1993-1998 model years while operating in Cruise mode. A 50% penetration rate would mean that half of these eligible tractors were reflashed, not that half of the fleet had been reflashed.

Additional insights can be gained from the DrayFLEET model technical report and the SmartWay Partnership website.

3.12.1 Particulate Filter/Trap (also know as Diesel Particulate filter or DPF)

Effects: Reduces emissions of PM, HC and CO; slight increase in fuel use and CO_2

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of eligible vehicles that implement the retrofit.

Notes: Engines certified to meet 2004 or later standards require exhaust after treatment and the presence of diesel particulate filters is already assumed in the emission rates from MOBILE6.

Therefore only pre-2004 model year trucks are eligible for this retrofit technology. DrayFLEET does not apply any benefit for 2004 or newer trucks.

3.12.2 Oxidation Catalyst

Effects: Reduces emissions of PM, HC and CO; no impact on NOx or fuel use.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of eligible vehicles that implement the retrofit.

Notes: A Diesel Oxidation Catalyst is an exhaust system device that reduces emissions of particulates and other pollutants. Engines certified to meet 2004 or later standards already require exhaust after treatment. Therefore only pre-2004 model year trucks are eligible for this retrofit technology.

3.12.3 Flow-Through Filter

Effects: Reduces emissions of PM, HC, and CO; no impact on NOx or fuel use.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of eligible vehicles that implement the retrofit.

Notes: A Flow-Through Filter is an exhaust system device that reduces emissions of particulates and other pollutants. Engines certified to meet 2004 or later standards already require exhaust after treatment. Therefore only pre-2004 model year trucks are eligible for this retrofit technology.

3.12.4 Idle Reduction

Effects: Reduces emissions of PM, HC, CO, saves fuel which is reflected in reduced CO_2

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of applicable idling that is eliminated.

Notes: The benefits from reduced idle are e only applied to idle mode activity (e.g., extended waiting). Idle occurring as part of other operating modes (e.g. queuing in Creep mode) would not be effected. For example, idling from delay at arterial intersections as part of transient mode would not be eliminated.

3.12.5 Single-Wide Tires

Effects: Reduces fuel consumption and CO_2 emissions.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of the drayage fleet that implements the technology.

Notes: The modeled emission benefit already accounts for the weight reduction associated with switching single rim/tire configurations. That weight reduction should not be considered included with analysis of Tare Weight Reduction.

3.12.6 Automatic Tire Inflation

Effects: Reduces fuel consumption and CO_2 emissions.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of the drayage fleet that implements the technology.

Notes: Automatic tire inflation systems monitor and continually adjust the level of pressurized air to tires, maintaining proper tire pressure even when the truck is moving.

3.12.7 Tare Weight Reduction

Effects: Reduces fuel consumption and CO_2 emissions.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of the drayage fleet that implements the technology. For reduction in tare weight, a second input box is provided for the user to specify the weight reduction achieved (in lb).

Notes: Since drayage tractors are usually second hand they often have features such as aerodynamic fairings and sleeper cabs that add weight but provide no benefit in drayage service. By removing unneeded features or buying a tractor without them, tare weight can be reduced and fuel conserved.

3.12.8 Low Friction Engine Lubricant

Effects: Reduces fuel consumption and CO_2 emissions.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of the drayage fleet that implements the technology.

Notes: Low-friction engine lubricants are usually synthetic, low-viscosity compounds.

3.12.9 Low Friction Drivetrain Lubricant

Effects: Reduces fuel consumption and CO_2 emissions.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of the drayage fleet that implements the technology.

Notes: Low-friction drivetrain lubricants are usually synthetic, low-viscosity compounds.

3.12.10 Direct Drivetrain

Effects: Reduces fuel consumption and CO_2 emissions.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of the drayage fleet that implements the technology.

Notes: Direct drivetrain technologies reduce weight and transmission losses, thereby conserving fuel.

3.12.11 Single-Axle Drive (vs. Dual Axle)

Effects: Reduces fuel consumption and CO_2 emissions.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of the drayage fleet that implements the technology.

Notes: Most tractors built for highway service have two rear axles, both powered. Where a tractor in urban service can dispense with the second powered axle, there is an opportunity to reduce weight and transmission losses.

3.12.12 Speed Management Policy (55 mph)

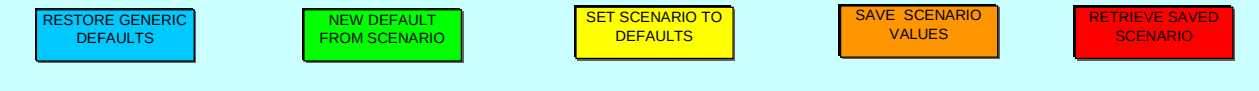
Effects: Reduces fuel consumption and CO_2 emissions.

User Input: The measure is activated by checking the control box. The user provides an estimate of the fraction of the drayage fleet that implements the strategy.

Notes: Whether implemented as a policy via driver training or through speed governors, a maximum speed management strategy conserves fuel. Emission benefits from speed management are only applied to Cruise Mode vehicle operation. The effect on drayage operations is limited, however, as very little of the time is spent at highway speeds.

3.13 Using DrayFLEET Macros to Manage Inputs

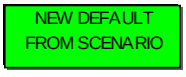
There are five macro buttons at the bottom of the Primary Inputs and Outputs worksheet (below).



These buttons can be used to manage default and scenario inputs on the Primary Inputs and Outputs and Secondary Inputs worksheets.

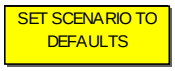
In DrayFLEET Version 1.0 these macros do not affect inputs on the Drayage Fleet Inputs, Cost and Capacity, or individual activity tally worksheets. Those inputs must still be managed manually in this version.

Restore Generic Defaults. This macro, activated by clicking the button, will replace the current default values on the main input pages with the original generic defaults stored in the model. Any customized default values will be overwritten. To preserve a customized base case, either save a separate version of the model (recommended) or do not use this button.



New Default from Scenario. The easiest way to create a customized default or base case model is to create a customized scenario and then, once the user is

satisfied, click this button to reset the default values to the new scenario. The Restore Generic Defaults button will reverse this process.



Set Scenario to Defaults. As the model comes the scenario values are set equal to the default values. Inputting new scenario values will override these formulas. Use this button to reset the scenario values equal to the *current* defaults (which could be the generic defaults or a user-created base case). To set the scenario values to the generic defaults, use the Restore Generic Defaults button first.

Save Scenario Values. DrayFLEET Version 1.0 will save one set of scenario inputs internally. Use this button to store those values in the model for reuse later. *Note that this button does not affect the scenario calendar year, which must be reset manually.*

Retrieve Saved Scenario. This button will replace the Scenario inputs on the Primary Inputs and Outputs and Secondary Inputs worksheets with the stored scenario values. The defaults can be set to the stored scenario values by using this button first, then using the New Default from Scenario button.

DrayFLEET Version 1.0 does not have safeguards against accidental use of these buttons and resulting loss of data. The user is urged to use them cautiously.

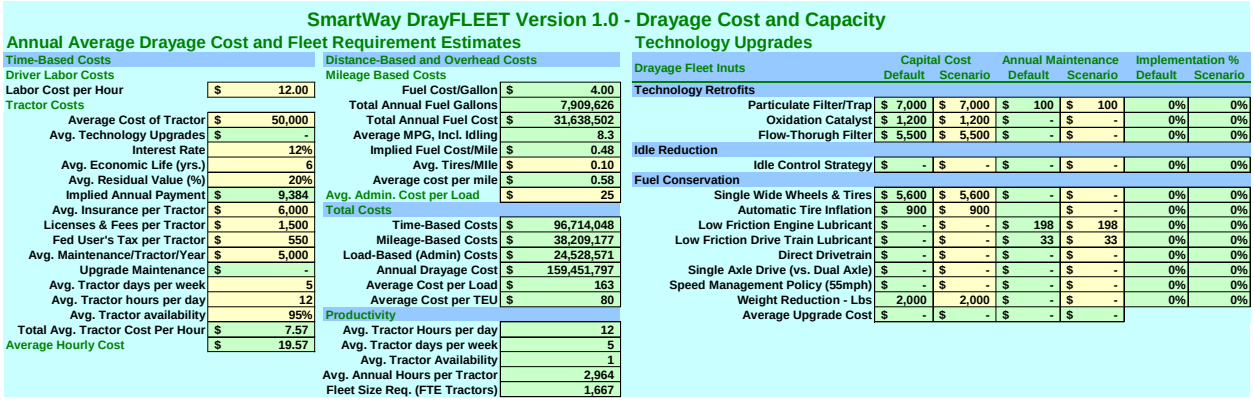
3.14 Cell and Sheet Protection

Cell locks and sheet protection are used where applicable in DrayFLEET to reduce the chance of inadvertently overwriting formulas. If necessary, the user can unprotect the sheet and unlock the cells by going to the Excel toolbar and selecting *Tools/Protection/Unprotect Sheet*. The default password is "shadow" (case sensitive). Caution is advised. The process can be reversed at the Excel toolbar using the user's choice of password.

4.0 Drayage Cost and Fleet Requirements

4.1 Cost & Capacity Worksheet

The Cost and Capacity worksheet (below) covers drayage cost, productivity, and the cost of technology upgrades.



SmartWay DrayFLEET Version 1.0 - Drayage Cost and Capacity

Annual Average Drayage Cost and Fleet Requirement Estimates

Time-Based Costs	
Driver Labor Costs	
Labor Cost per Hour	$ 12.00
Tractor Costs	
Average Cost of Tractor	$ 50,000
Avg. Technology Upgrades	$ -
Interest Rate	12%
Avg. Economic Life (yrs.)	6
Avg. Residual Value (%)	20%
Implied Annual Payment	$ 9,384
Avg. Insurance per Tractor	$ 6,000
Licenses & Fees per Tractor	$ 1,500
Fed User's Tax per Tractor	$ 550
Avg. Maintenance/Tractor/Year	$ 5,000
Upgrade Maintenance	$ -
Avg. Tractor days per week	5
Avg. Tractor hours per day	12
Avg. Tractor availability	95%
Total Avg. Tractor Cost Per Hour	$ 7.57
Average Hourly Cost	$ 19.57

Distance-Based and Overhead Costs	
Mileage Based Costs	
Fuel Cost/Gallon	$ 4.00
Total Annual Fuel Gallons	7,909,626
Total Annual Fuel Cost	$ 31,638,502
Average MPG, Incl. Idling	8.3
Implied Fuel Cost/Mile	$ 0.48
Avg. Tires/MIle	$ 0.10
Average cost per mile	$ 0.58
Avg. Admin. Cost per Load	$ 25
Total Costs	
Time-Based Costs	$ 96,714,048
Mileage-Based Costs	$ 38,209,177
Load-Based (Admin) Costs	$ 24,528,571
Annual Drayage Cost	$ 159,451,797
Average Cost per Load	$ 163
Average Cost per TEU	$ 80
Productivity	
Avg. Tractor Hours per day	12
Avg. Tractor days per week	5
Avg. Tractor Availability	1
Avg. Annual Hours per Tractor	2,964
Fleet Size Req. (FTE Tractors)	1,667

Technology Upgrades

Drayage Fleet Inuts	Capital Cost Default	Capital Cost Scenario	Annual Maintenance Default	Annual Maintenance Scenario	Implementation % Default	Implementation % Scenario
Technology Retrofits						
Particulate Filter/Trap	$ 7,000	$ 7,000	$ 100	$ 100	0%	0%
Oxidation Catalyst	$ 1,200	$ 1,200	$ -	$ -	0%	0%
Flow-Thorugh Filter	$ 5,500	$ 5,500	$ -	$ -	0%	0%
Idle Reduction						
Idle Control Strategy	$ -	$ -	$ -	$ -	0%	0%
Fuel Conservation						
Single Wide Wheels & Tires	$ 5,600	$ 5,600	$ -	$ -	0%	0%
Automatic Tire Inflation	$ 900	$ 900		$ -	0%	0%
Low Friction Engine Lubricant	$ -	$ -	$ 198	$ 198	0%	0%
Low Friction Drive Train Lubricant	$ -	$ -	$ 33	$ 33	0%	0%
Direct Drivetrain	$ -	$ -	$ -	$ -	0%	0%
Single Axle Drive (vs. Dual Axle)	$ -	$ -	$ -	$ -	0%	0%
Speed Management Policy (55mph)	$ -	$ -	$ -	$ -	0%	0%
Weight Reduction - Lbs	2,000	2,000	$ -	$ -	0%	0%
Average Upgrade Cost	$ -	$ -	$ -	$ -		

4.2 Drayage Cost

The drayage cost model is in three sections: Time-Based Costs, Distance-Based and Overhead Costs, and a Total Cost Estimate.

The Time-Based Costs, below, include labor, tractor ownership, and time-based tractor maintenance.

Time-Based Costs	
Driver Labor Costs	
Labor Cost per Hour	$ 12.00
Tractor Costs	
Cost of Tractor	$ 50,000
Technology Upgrades	$ -
Interest Rate	12%
Economic Life (yrs.)	6
Residual Value (%)	20%
Implied Annual Payment	$ 9,384
Insurance per Tractor	$ 6,000
Licenses & Fees per Tractor	$ 1,500
Fed User's Tax per Tractor	$ 550
Maintenance/Tractor/Year	$ 5,000
Upgrade Maintenance	$ -
Tractor days per week	5
Tractor hours per day	12
Tractor availability	95%
Total Tractor Cost Per Hour	$ 7.57
Average Hourly Cost	$ 19.57

Labor Cost per Hour – Default $12.00. Linked to Primary Inputs worksheet.

Financial Variables. The financials variables shown in the tan shaded cells above are typical industry defaults. Enter new default values if more specific information is available on prevalent local practices.

The average hourly cost is the sum of labor and other time-based costs above.

The Distance-Based and Overhead costs below include fuel, tires, and administrative costs.

Distance-Based and Overhead Costs		
Mileage Based Costs		
Fuel Cost/Gallon	$	4.00
Annual Fuel Gallons		7,799,545
Average MPG, Incl. Idling		6.1
Implied Fuel Cost/Mile	$	0.66
Tires/Mile	$	0.10
Average cost per mile	$	0.76
Annual Fuel Cost	$	31,198,180
Avg. Admin. Cost per Load	$	25

Fuel Cost/Gallon – Default $4.00. Linked to the Primary Inputs worksheet.

Annual Fuel Gallons – Calculated by the Emissions model based on very detailed consumption rates in each operating mode. This value is not calculated from the average MPG value.

Average MPG, Including Idling – Calculated from total miles traveled and total fuel consumed. This is a model output, not an input.

Implied Fuel Cost per Mile – Calculated by the model.

Tires/Mile – Default $0.10 per mile. The default is an industry norm. Enter more precise data if available. Note that this value is for the tractor tires only, not the chassis tires.

Overhead Cost per Load – Default $25.00. The default is an industry rule-of-thumb. Enter more precise local data if available. Note that overhead is only assessed against loaded moves.

The Total Cost Estimate below is calculated by the model. There are no user entries.

Total Costs		
Time-Based Costs	$	88,896,998
Mileage-Based Costs	$	35,946,103
Load-Based (Admin) Costs	$	24,528,571
Annual Drayage Cost	$	149,371,672
Average Cost per Load	$	152
Average Cost per TEU	$	75

Averages are displayed for convenience, and the results are linked to the Primary Inputs and Outputs worksheet.

4.3 Productivity and Fleet Requirements

The fleet requirement analysis below is straightforward and entails no user entries. The tractor hours per week, tractor days per week, and tractor availability are linked to the cost model discussed above. These three factors together yield the annual operating hours available from each tractor.

Productivity	
Tractor Hours per day	12
Tractor days per week	5
Tractor Availability	1
Annual Hours per Tractor	2,964
Fleet Size Req. (FTE Tractors)	1,533

Dividing the total drayage hours (estimated by the model) by the hours available from a tractor engaged full-time in drayage yields the number of full-time-equivalent (FTE) tractors required. This result is displayed on the Primary Inputs and Outputs worksheet.

The FTE estimate provided by the model is most useful in comparing the fleet requirements of default and scenario cases. Note that the actual drayage fleet in most ports consist of a mix of tractors used full-time in port drayage and tractors whose time is split with other uses. The actual number of tractors in the fleet thus varies widely, and includes both full-time and part-time units.

4.4 Technology Upgrade Costs

This worksheet also includes cost estimates for the various emissions control and fuel conservation technologies discussed in an earlier section. For each technology option there is a capital cost, an annual maintenance cost, and an implementation percentage as applicable.

Drayage Fleet Inuts	Capital Cost		Annual Maintenance		Implementation %	
	Default	Scenario	Default	Scenario	Default	Scenario
Technology Retrofits						
Particulate Filter/Trap	$ 7,000	$ 7,000	$ 100	$ 100	0%	0%
Oxidation Catalyst	$ 1,200	$ 1,200	$ -	$ -	0%	0%
Flow-Thorugh Filter	$ 5,500	$ 5,500	$ -	$ -	0%	0%
Idle Reduction						
Idle Control Strategy	$ -	$ -	$ -	$ -	0%	0%
Fuel Conservation						
Single Wide Wheels & Tires	$ 5,600	$ 5,600	$ -	$ -	0%	0%
Automatic Tire Inflation	$ 900	$ 900		$ -	0%	0%
Low Friction Engine Lubricant	$ -	$ -	$ 198	$ 198	0%	0%
Low Friction Drive Train Lubricant	$ -	$ -	$ 33	$ 33	0%	0%
Direct Drivetrain	$ -	$ -	$ -	$ -	0%	0%
Single Axle Drive (vs. Dual Axle)	$ -	$ -	$ -	$ -	0%	0%
Speed Management Policy (55mph)	$ -	$ -	$ -	$ -	0%	0%
Weight Reduction - Lbs	2,000	2,000	$ -	$ -	0%	0%
Average Upgrade Cost	$ -	$ -	$ -	$ -		

The tan-shaded cells provide options for user input. The implementation percentages are linked to the Drayage Fleet Inputs.

5.0 Model Outputs

5.1 Resetting Base Case Default Outputs

As noted above, changing the default values will automatically change the scenario values, thereby changing the scenario outputs. Once a complete set of default input values has been entered, the scenario outputs correspond to the new inputs and the default output values must be reset accordingly.

To reset the default output values, click the New Default from Scenario button. This will reset the default outputs to equal the scenario outputs.

At this point the model provides a base case estimate of drayage activities, costs, and emissions for the port or terminal being modeled. This base case, which should be saved under a new file name, then becomes the default against which new scenarios can be compared.

5.2 Activity Outputs

The measures of physical drayage activity are shown below.

Activity Outputs	Default	Scenario	Change	% Change
Annual Activity				
Number of Drayage Trip Legs	3,498,452	3,498,452	0	0.0%
Drayage Trip Legs per Container	3.1	3.1	0.0	0.0%
Total Drayage VMT	65,706,753	65,706,753	0	0.0%
Drayage VMT per Container	57.5	57.5	0.0	0.0%
Fleet Required (FTE Tractors)	1,224	1,224	0	0.0%
Annual Duty Cycle Totals				
Idle Hours	1,869,294	1,869,294	0	0.0%
Creep Hours	994,223	994,223	0	0.0%
Transient Hours	572,700	572,700	0	0.0%
Cruise Hours	1,506,026	1,506,026	0	0.0%
Total Drayage Hours	4,942,243	4,942,243	0	0.0%
Drayage Hours per Container	4.3	4.3	0.0	0.0%

The Annual Activity measures gauge the work being performed by drayage tractors and drivers to transfer containers between facilities. The Fleet Required is measured in full-time equivalents (FTE); typical port drayage fleets are a mix of full-time and part-time participants and will be larger than the FTE shown. Total cost covers labor, fuel, tractors, maintenance, etc. The Duty Cycle Totals are particularly significant as they determine the emissions estimates.

5.3 Emissions Outputs

Emissions Outputs	Default	Scenario	Change	% Change
Pollutant (annual tons)				
HC	53	53	0.00	0.0%
CO	298	298	0.00	0.0%
NOx	1,108	1,108	0.00	0.0%
PM_{10}	37	37	0.00	0.0%
$PM_{2.5}$	31	31	0.00	0.0%
CO_2	88,497	88,497	0	0.0%
Fuel Use and Total Cost				
Fuel - Gallons	7,909,626	7,909,626	0.0	0.0%
Total Drayage Cost	$ 159,451,797	$ 159,451,797	$ -	0.0%
Drayage Cost per Container	$ 140	$ 140	$ -	0.0%

The emissions outputs give estimated annual tons of six different pollutants. As pollutant emissions mix varies with the duty cycle, the proportions will change under various scenarios. Fuel Use is listed under Emissions but it is also a major factor in the estimated cost.

5.4 Activity Summary

The Activity Summary worksheet assemblies the results from the drayage activity sheets. The number of trips is summed, and connected to remove double-counting. Otherwise, for example, a marine terminal-to-rail trip would be counted on both ends. There are no user inputs for this page.

SmartWay DrayFLEET Version 1.0 - Summary of Detailed Drayage Activity

Activity Group	Number of Trips	Distance (Miles)	Idle (%)	Creep (%)	Transient (%)	Cruise (%)	Idle (hours)	Creep (hours)	Transient (hours)	Cruise (hours)	Total (hours)
Loaded Drayage											
Marine Terminal	981,143	970,866	64%	32%	4%	0%	525,415	266,830	31,855	-	824,100
Inter-Terminal	5,429	21,714	17%	7%	19%	58%	139	59	155	482	834
Off-Dock Rail Terminal	242,857	944,523	44%	13%	20%	22%	53,921	16,029	24,413	26,950	121,313
Container Depot	-	-	0%	0%	0%	0%	-	-	-	-	-
Shippers & Receivers	728,571	18,352,714	29%	10%	15%	46%	259,756	85,528	134,370	404,247	883,901
Crosstown Trips	-	-	20%	7%	18%	56%	33,297	11,534	30,529	94,966	170,326
Other Port Trucks	-	-	0%	0%	0%	0%	-	-	-	-	-
Net Subtotal*	**976,857**	**19,318,951**	**44%**	**19%**	**11%**	**26%**	**872,528**	**379,980**	**221,321**	**526,645**	**2,000,474**
Empty/Chassis/Bobtail Drayage											
Marine Terminal	1,606,696	13,065,180	42%	32%	8%	18%	596,481	463,908	111,802	263,368	1,435,559
Inter-Terminal	286	1,143	17%	7%	19%	58%	7	3	8	25	44
Off-Dock Rail Terminal	104,060	423,240	41%	13%	20%	27%	17,927	5,443	8,518	11,548	43,436
Container Depot	69,916	154,695	65%	18%	5%	11%	17,902	5,062	1,333	3,103	27,401
Shippers & Receivers	1,092,857	27,492,643	26%	10%	16%	48%	331,151	128,292	199,189	606,371	1,265,003
Crosstown Trips	427,889	4,280,035	20%	7%	18%	56%	33,297	11,534	30,529	94,966	170,326
Other Port Trucks	-	-	0%	0%	0%	0%	-	-	-	-	-
Net Subtotal*	**2,521,595**	**45,416,936**	**34%**	**21%**	**12%**	**33%**	**996,766**	**614,243**	**351,379**	**979,382**	**2,941,769**
Total Drayage											
Marine Terminal	2,587,839	14,036,046	50%	32%	6%	12%	1,121,896	730,738	143,657	263,368	2,259,659
Inter-Terminal	5,714	22,857	17%	7%	19%	58%	146	62	163	507	878
Off-Dock Rail Terminal	346,917	1,367,763	44%	13%	20%	23%	71,848	21,472	32,931	38,497	164,749
Container Depot	69,916	154,695	65%	18%	5%	11%	17,902	5,062	1,333	3,103	27,401
Shippers & Receivers	1,821,429	45,845,357	27%	10%	16%	47%	590,906	213,821	333,559	1,010,619	2,148,904
Crosstown Trips	427,889	4,280,035	20%	7%	18%	56%	66,595	23,069	61,058	189,931	340,653
Other Port Trucks	-	-	0%	0%	0%	0%	-	-	-	-	-
Net Total*	**3,498,452**	**65,706,753**	**38%**	**20%**	**12%**	**30%**	**1,869,294**	**994,223**	**572,700**	**1,506,026**	**4,942,243**

The large amount of information displayed here is primarily useful for identifying differences between scenarios and for tracing the impact of changes throughout the drayage duty cycle.

6.0 Creating Model Scenarios

6.1 Overview

It is recommend that the user take an organized and deliberate approach to creating new model scenarios. In principle, any change to a scenario value creates a new scenario. The model is sufficiently sensitive that adding a single TEU to an annual total of over 15 million TEU will add minutes, miles, fuel gallons, costs, and emissions. The user is encouraged to consult the project report for information on data sources.

6.2 Scenario-Default Comparisons

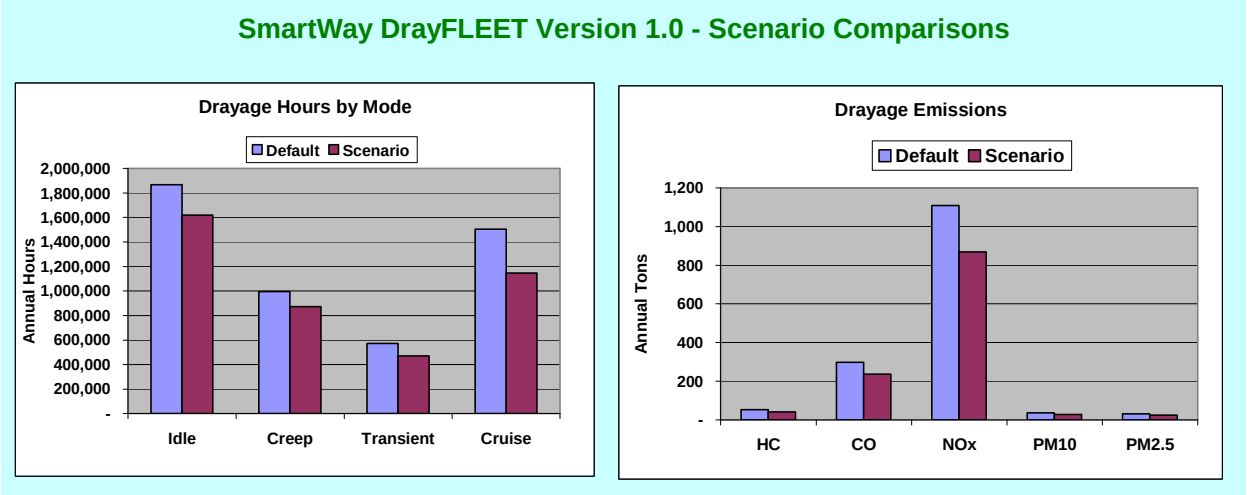
The lower portion of the Primary Inputs and Outputs worksheet provides high-level comparisons of Default and Scenario activity and emissions estimates (below).

Activity Outputs	Default	Scenario	Change	% Change
Annual Activity				
Number of Drayage Trip Legs	3,498,452	3,498,452	0	0.0%
Drayage Trip Legs per Container	3.1	3.1	0.0	0.0%
Total Drayage VMT	65,706,753	65,706,753	0	0.0%
Drayage VMT per Container	57.5	57.5	0.0	0.0%
Fleet Required (FTE Tractors)	1,224	1,224	0	0.0%
Annual Duty Cycle Totals				
Idle Hours	1,869,294	1,869,294	0	0.0%
Creep Hours	994,223	994,223	0	0.0%
Transient Hours	572,700	572,700	0	0.0%
Cruise Hours	1,506,026	1,506,026	0	0.0%
Total Drayage Hours	4,942,243	4,942,243	0	0.0%
Drayage Hours per Container	4.3	4.3	0.0	0.0%

Emissions Outputs	Default	Scenario	Change	% Change
Pollutant (annual tons)				
HC	53	53	0.00	0.0%
CO	298	298	0.00	0.0%
NOx	1,108	1,108	0.00	0.0%
PM_{10}	37	37	0.00	0.0%
$PM_{2.5}$	31	31	0.00	0.0%
CO_2	88,497	88,497	0	0.0%
Fuel Use and Total Cost				
Fuel - Gallons	7,909,626	7,909,626	0.0	0.0%
Total Drayage Cost	$ 159,451,797	$ 159,451,797	$ -	0.0%
Drayage Cost per Container	$ 140	$ 140	$ -	0.0%

6.3 Scenario Comparisons

This worksheet displays two graphs comparing the most important model outputs: drayage hours by operating mode, and emissions (CO_2 is not shown since its scale is radically different). The example shows an instance which increased on-dock rail intermodal handling has reduced drayage hours and emissions.



6.4 *Changing and Reversing Scenario Inputs*

Individual scenario input values can be easily changed to observe the impact on model outputs using standard Excel features. For example, the graphic below shows a change from a 30 minute average for container yard transactions (default) to a scenario with a 15-minute average, resulting in reduced emissions and cost savings.

SmartWay DrayFLEET Version 1.0 Primary Inputs & Outputs — DrayFLEET Version 1.0F of 07/30/2008

Primary Inputs	Default	Scenario
Port		
Calendar Year	2007	2007
Annual TEU	2,000,000	2,000,000
Average TEU per Container	1.75	1.75
Inbound Share	50%	50%
Inbound Empty Share	5%	5%
Outbound Empty Share	25%	25%
Rail Intermodal Share	25%	25%
Marine Terminals		
Average Inbound Gate Queue Minutes	15	15
Average Marine Terminal Min. per Transaction	30	15
Rail Terminals		
Weighted Average Miles from Port	5	5
Average Inbound Gate Queue Minutes	5	5
Average Rail Yard Min. per Transaction	15	15
Container Depots		
Weighted Average Miles from Port	2	2
Share of Empties Stored at Depots	10%	10%
Container Shippers/Receivers		
Weighted Average Miles from Port	25	25
Weighted Average Crosstown Trip Miles	10	10
Cost Factors		
Average Drayage Labor Cost per Hour	$ 12.00	$ 12.00
Average Diesel Fuel Price per Gallon	$ 4.00	$ 4.00

Initiative Inputs	Default	Scenario
Port/Terminal Initiatives		
Stacked Terminal (% stacked)	0%	0%
On-Dock Rail (% of rail on-dock)	0%	0%
Automated Gates (% of gate transactions)	0%	0%
Extended Gate Hours (% off-peak, 50% max)	0%	0%
Container Info System (% used)	0%	0%
Virtual Container Yard (% available)	0%	0%
Neutral Chassis Pool (% used)	0%	0%

Port	
Terminal(s)	
Scenario	
Date	

Activity Outputs	Default	Scenario	Change	% Change
Annual Activity				
Number of Drayage Trip Legs	3,826,235	3,826,235	0	0.0%
Drayage Trip Legs per Container	3.3	3.3	0.0	0.0%
Total Drayage VMT	68,413,994	68,413,994	0	0.0%
Drayage VMT per Container	59.9	59.9	0.0	0.0%
Fleet Required (FTE Tractors)	1,756	1,608	-148	-8.4%
Annual Duty Cycle Totals				
Idle Hours	1,957,060	1,519,171	-437,890	-22.4%
Creep Hours	1,089,182	1,089,182	0	0.0%
Transient Hours	597,318	597,318	0	0.0%
Cruise Hours	1,559,766	1,559,766	0	0.0%
Total Drayage Hours	5,203,327	4,765,437	-437,890	-8.4%
Drayage Hours per Container	4.6	4.2	-0.4	-8.4%

Emissions Outputs	Default	Scenario	Change	% Change
Pollutant (annual tons)				
HC	55	54	-1.18	-2.1%
CO	311	304	-6.98	-2.2%
NOx	1,154	1,136	-17.95	-1.6%
PM_{10}	38	37	-0.54	-1.4%
$PM_{2.5}$	32	32	-0.46	-1.4%
CO_2	145,037	142,881	-2,155.70	-1.5%
Fuel Use and Total Cost				
Fuel - Gallons	12,963,067	12,770,395	-192,671.4	-1.5%
Total Drayage Cost	$ 185,045,398	$ 175,705,714	$ (9,339,684)	-5.0%
Drayage Cost per Container	$ 162	$ 154	$ (8)	-5.0%

To reverse the changes use Excel's Undo Command, either by choosing "Undo" from the drop-down menu under "Edit" on the Excel toolbar, or via the CTRL+Z keyboard shortcut. Excel can track and undo up to 15 changes of this type, although other activity in the interim may prevent undoing the changes. To restore an individual Base Case value, set the Scenario cell equal to the corresponding Default cell. To restore them all, use the Set Scenario to Defaults button.

There are multiple ways to save a copy of the Primary Inputs & Outputs worksheet as a record of scenario inputs and outputs.

- Print a hard copy[3] of the worksheet.
- Use Paste Special in Word to insert an image of the worksheet into a Word document as a Picture[4].
- Use Adobe Acrobat®, Scansoft PDF Create!®, or other software to save an image of the worksheet as a PDF file.

This simple approach is convenient and useful for exploring the impact of one or two variables, but quickly becomes unmanageable for more complex scenarios.

[3] This will not, however, show any changes that have been made on other model worksheets, such as the detailed inputs on the drayage activity sheets.

[4] Do not attempt to paste the worksheet as a Microsoft Excel Object.

7.0 Optional Detailed Input Values

7.1 Drayage Activity Sheets: Common Features

Drayage Activity sheets track the drayage miles and minutes for each activity and allocate them between idle, creep, transition, and cruise duty cycles. Each tally sheet uses trip data from the default values or the user scenario and outputs activity and duty cycle data to a summary sheet.

Detailed default values on the tally sheets (e.g. the time needed to transfer a container between two chassis) can be changed by the user if desired. The default values for each of the four model versions are based on a combination of regional data and industry rules-of-thumb. Wherever the user can input more accurate values for local conditions, the accuracy and realism of the model will improve.

All of the activity tally spreadsheets employ a common format and approach, with changes in the nomenclature and content to suit the application. The Marine Terminal tally sheet, which is the most complex, is shown below as an example.

Marine Terminal Drayage Activity

RESTORE GENERIC DEFAULTS

This worksheet reflects movements of loaded containers, empty containers, bare chassis, and bobtail tractors to and from marine container terminals

Note: OB/Export Containers come IN to the Marine Terminal Gate, and vice versa

Activity	Trips	%	Duration (Minutes)	Waiting Time (Minutes)	Travel Time (minutes)	Distance (Miles)
Outbound/Export Containers			= user changeable inputs			
Total Containers Entering Terminal Gate	**881,181**					
Loaded Containers	**432,857**	33%			(over-the-road movement shown on other worksheets)	
Empty Containers	**448,324**	35%				
Bare Chassis	**27,541**	2%	12	-	12	**5**
Bobtail Tractors	**385,197**	30%	35	-	35	**15**
Total Trips	**1,293,919**	**100%**				
Entry Gate Transactions						
Entry Gate Transaction	**1,293,919**	100%	**3**	3	-	-
Outside Queuing	**1,293,919**	100%	**15**		15	0.5
Trouble Window	**64,696**	**5%**	**45**	41	4	0.1
Bypass Entrance	**-**	0%	**1**	-	1	0.3
Container Yard Activity						
Pick Up Loaded Container on Chassis	**548,286**	30%	**27**	25	2	0.5
Pick Up Empty Container on Chassis	**331,786**	18%	**27**	25	2	0.5
Locate & Pick Up Bare Chassis	**25,672**	1%	**27**	15	2	0.5
Drop Loaded Container on Chassis	**432,857**	24%	**27**	25	2	0.5
Drop Empty Container on Chassis	**448,324**	25%	**27**	25	2	0.5
Drop Bare Chassis	**27,541**	2%	**5**	5	2	0.5
Chassis Flip/Transfer	**8,801**	0%	**42**	40	2	0.5
Live Lift Container onto Chassis	**-**	0%	**27**	27	0	0.1
Live Lift Container off of Chassis	**-**	0%	**27**	27	0	0.1
Total Transactions	**1,823,266**	**100%**				
Container Yard Delays						
Trouble Window	**91,163**	5%	**30**	27	3	0.1
Equipment Issue	**45,287**	5%	**60**	52	8	0.3
Inbound/Import Containers						
Total Containers Exiting Terminal Gate	**880,071**					
Loaded Containers	**548,286**	42%			(over-the-road movement shown on other worksheets)	
Empty Containers	**331,786**	26%				
Bare Chassis	**25,672**	2%	12	-	12	**5**
Bobtail Tractors	**388,176**	30%	35	-	35	**15**
Total Trips	**1,293,919**	**100%**				
Exit Gate Transactions						
Exit Gate Transaction	**1,293,919**	100%	**3**	5	-	-
Inside Queuing	**1,293,919**	100%	**5**		17	0.5
Trouble Window	**64,696**	**5%**	**30**	-	-	-
Bypass Exit	**-**	0%	**1**		-	
Loaded Subtotal	**981,143**	**38%**	**49,446,025**	**31,524,895**	**17,921,130**	**970,866**
Bobtail/Chassis/Empty Subtotal	**1,606,696**	**62%**	**86,133,537**	**35,788,879**	**50,344,659**	**13,065,180**
Marine Terminal Total	**2,587,839**	**100%**	**135,579,562**	**67,313,774**	**68,265,789**	**14,036,046**

On the left the tally sheets list possible activities. The list is similar across the various facility types, although not all activities take place in every location. The cells hold either values linked to other sheets, calculated values, output values, or optional input variables, as shown above. Cells containing calculated values and output values are locked. Cells shaded in tan allow user inputs.

The outputs are totaled separately for loaded containers and for unloaded equipment (bobtails, bare chassis, and empty containers). The tally sheets contain hidden cells in which the minutes by duty cycle phase are multiplied by the number of trips in each category and totaled. The output cells are ultimately linked to the Primary Inputs and Outputs and Activity Summary sheets.

Operating Modes. This section of each activity tally spreadsheet (below), which is ordinarily hidden, is a critical factor in the emissions estimates. Duty cycle data are scarce, so the model supplies a series of appropriate default values. The default duty cycle for over-the-road trips on this and other spreadsheets is the California Air Resources Board (CARB) Highway Heavy Duty Diesel Truck (HHDDT) test cycle of 16.6% Idle, 7.0% creep, 15.4% transient, and 57.8% Cruise.

The complete duty cycle is applied only to the over-the-road activities within the drayage activity model, not to terminal activities or queuing. For most activities the tally sheet tracks waiting time (modeled at Idle) separately from movement time. The movement time is modeled at Creep (average of 1.8 mph, for gate transactions and queuing) or at Transient (average of 15.4 mph, for movement within the yard and through bypass gates).

The tally sheet tracks the minutes accumulated in each operating mode and the total distance traveled. These results are reported separately for loaded moves and for empty, bare chassis, and bobtail moves combined.

Each activity tally sheet has a comparable operating cycle section which is normally hidden as there are no user inputs or displays of results.

The sections that follow cover the individual Drayage Activity sheets and the detailed input options.

OPERATING MODE SPEEDS

CUMULATIVE OPERATING MODE TIMES

CUMULATIVE OPERATING MILEAGE

OPERATING MODE ASSIGNMENT

Activity	Idle %	Creep %	Transient %	Cruise %	Avg. Trav MPH	(minutes)	Creep (minutes)	Transient (minutes)	Cruise (minutes)	Total (m	Total Miles
Outbound/Export Containers	0	1.8	15.4	39.9							
Total Containers Entering Terminal Gate											
Loaded Containers											
Empty Containers											
Bare Chassis	16.6%	7.0%	18.5%	57.8%	26.0	52,821	22,273	58,807	183,376	317,277	137,707
Bobtail Tractors	16.6%	7.0%	18.5%	57.8%	26.0	2,216,270	934,527	2,467,448	7,694,152	13,312,398	5,777,959
Total Trips											
Entry Gate Transactions											
Entry Gate Transaction	0%	100%	0%	0%	1.8	3,881,758	-	-	-	3,881,758	-
Outside Queuing	0%	100%	0%	0%	1.8	-	19,408,791	-	-	19,408,791	582,264
Trouble Window	0%	100%	0%	0%	1.8	2,641,752	269,567	-	-	2,911,319	8,087
Bypass Entrance	0%	0%	100%	0%	15.4	-	-	-	-	-	-
Container Yard Ac											
Pick Up Loaded		0%	100%	0%	15.4	5,511,340	-	1,068,089	-	6,579,429	274,143
Pick Up Empty		0%	100%	0%	15.4	3,335,093	-	646,336	-	3,981,429	165,893
Locate & Pick Up Bare Chassis	0%	0%	100%	0%	15.4	385,082	-	50,011	-	435,093	12,836
Drop Loaded Container on Chassis	0%	0%	100%	0%	15.4	4,351,058	-	843,228	-	5,194,286	216,429
Drop Empty Container on Chassis	0%	0%	100%	0%	15.4	4,506,525	-	873,358	-	5,379,883	224,162
Drop Bare Chassis	0%	0%	100%	0%	15.4	137,707	-	53,652	-	191,359	13,771
Chassis Flip/Transfer	0%	0%	100%	0%	15.4	220,475	-	17,144	-	237,619	4,400
Live Lift Container onto Chassis	0%	0%	100%	0%	15.4	-	-	-	-	-	-
Live Lift Container off of Chassis	0%	0%	100%	0%	15.4	-	-	-	-	-	-
Total Transactions											
Container Yard Delays											
Trouble Window	0%	100%	0%	0%	1.8	2,431,022	303,878	-	-	2,734,900	9,116
Equipment Issue	0%	100%	0%	0%	1.8	2,339,838	377,393	-	-	2,717,231	11,322
Inbound/Import Containers											
Total Containers Exiting Terminal Gate											
Loaded Containers											
Empty Containers											
Bare Chassis	16.6%	7.0%	18.5%	57.8%	26.0	49,236	20,761	54,816	170,930	295,743	128,361
Bobtail Tractors	16.6%	7.0%	18.5%	57.8%	26.0	2,233,408	941,754	2,486,528	7,753,648	13,415,337	5,822,637
Total Trips											-
Exit Gate Transactions											
Exit Gate Transaction	0%	100%	0%	0%	1.8	6,469,597	-	-	-	6,469,597	-
Inside Queuing	0%	100%	0%	0%	1.8	-	21,565,323	-	-	21,565,323	646,960
Trouble Window	0%	100%	0%	0%	1.8	-	-	-	-	-	-
Bypass Exit	0%	0%	100%	0%	15.4	-	-	-	-	-	-
Loaded Subtotal	**16,807,752**	**16,009,813**	**1,911,317**	**-**		**16,807,752**	**16,009,813**	**1,911,317**	**-**	**34,728,882**	**970,866**
Bobtail/Chassis/Empty Subtotal	**23,955,229**	**27,834,453**	**6,708,099**	**15,802,106**		**23,955,229**	**27,834,453**	**6,708,099**	**15,802,106**	**74,299,887**	**13,065,180**
Marine Terminal Total	**40,762,981**	**43,844,266**	**8,619,416**	**15,802,106**		**40,762,981**	**43,844,266**	**8,619,416**	**15,802,106**	**109,028,770**	**14,036,046**

Operating Mode and Activity Tallies

7.2 Marine Terminal Worksheet

The Marine Terminal sheet covers the drayage activity within the marine terminal and at the marine terminal gates. Trips to and from the marine terminals are covered in other sheets.

Marine Terminal Drayage Activity

This worksheet reflects movements of loaded containers, empty containers, bare chassis, and bobtail tractors to and from marine container terminals

RESTORE GENERIC DEFAULTS

Note: OB/Export Containers come IN to the Marine Terminal Gate, and vice versa

Activity	Trips	%	Duration (Minutes)	Waiting Time (Minutes)	Travel Time (minutes)	Distance (Miles)
Outbound/Export Containers			= user changeable inputs			
Total Containers Entering Terminal Gate	**881,181**					
Loaded Containers	**432,857**	33%			(over-the-road movement shown on other worksheets)	
Empty Containers	**448,324**	35%				
Bare Chassis	**27,541**	2%	12	-	12	**5**
Bobtail Tractors	**385,197**	30%	35	-	35	**15**
Total Trips	**1,293,919**	**100%**				
Entry Gate Transactions						
Entry Gate Transaction	**1,293,919**	100%	**3**	3	-	-
Outside Queuing	**1,293,919**	100%	**15**		15	0.5
Trouble Window	**64,696**	**5%**	**45**	41	4	0.1
Bypass Entrance	**-**	0%	**1**	-	1	0.3
Container Yard Activity						
Pick Up Loaded Container on Chassis	**548,286**	30%	**27**	25	2	0.5
Pick Up Empty Container on Chassis	**331,786**	18%	**27**	25	2	0.5
Locate & Pick Up Bare Chassis	**25,672**	1%	**27**	15	2	0.5
Drop Loaded Container on Chassis	**432,857**	24%	**27**	25	2	0.5
Drop Empty Container on Chassis	**448,324**	25%	**27**	25	2	0.5
Drop Bare Chassis	**27,541**	2%	**5**	5	2	0.5
Chassis Flip/Transfer	**8,801**	0%	**42**	40	2	0.5
Live Lift Container onto Chassis	**-**	0%	**27**	27	0	0.1
Live Lift Container off of Chassis	**-**	0%	**27**	27	0	0.1
Total Transactions	**1,823,266**	**100%**				
Container Yard Delays						
Trouble Window	**91,163**	5%	**30**	27	3	0.1
Equipment Issue	**45,287**	5%	**60**	52	8	0.3
Inbound/Import Containers						
Total Containers Exiting Terminal Gate	**880,071**					
Loaded Containers	**548,286**	42%			(over-the-road movement shown on other worksheets)	
Empty Containers	**331,786**	26%				
Bare Chassis	**25,672**	2%	12	-	12	**5**
Bobtail Tractors	**388,176**	30%	35	-	35	**15**
Total Trips	**1,293,919**	**100%**				
Exit Gate Transactions						
Exit Gate Transaction	**1,293,919**	100%	**3**	5	-	-
Inside Queuing	**1,293,919**	100%	**5**		17	0.5
Trouble Window	**64,696**	**5%**	**30**	-	-	-
Bypass Exit	**-**	0%	**1**		-	
Loaded Subtotal	**981,143**	**38%**	**49,446,025**	**31,524,895**	**17,921,130**	**970,866**
Bobtail/Chassis/Empty Subtotal	**1,606,696**	**62%**	**86,133,537**	**35,788,879**	**50,344,659**	**13,065,180**
Marine Terminal Total	**2,587,839**	**100%**	**135,579,562**	**67,313,774**	**68,265,789**	**14,036,046**

Activity Percentages. This column contains the percentage of all movements through the marine terminal that are involved in specific activities, such as trips to a trouble window to resolve paperwork problems. Values with tan shading can be replaced by the user. All the other percentages are driven by the model.

Activity Durations. This column assigns the appropriate number of minutes to each drayage activity. The cells shaded in tan are defaults but may be changed by the user.

Distances. The distances on this sheet are within the terminal or at the terminal gates, not between terminals or other facilities. The tan values may be replaced by the user – others are calculated.

Note that the marine terminal worksheet has its own "Restore Generic Defaults" button, as some of the tan cells that might be changed by the user contain formulas that would otherwise be lost.

7.3 Off-Dock Rail Terminal Spreadsheet

The Off-Dock Rail Terminal portion of the model reflects drayage trips to and from port terminals, and port-related activity at and within the rail facility.

Off-Dock Rail Terminal Drayage Activity

This worksheet reflects movements of loaded containers, empty containers, bare chassis, and bobtail tractors to and from off-dock rail intermodal terminals

Note: Inbound/Import containers come IN to the Rail Terminal Entry Gate, and vice versa

Activity	Trips	%	Duration (Minutes)	Waiting Time	Travel Time	Distance (Miles)
Inbound/Import Containers			= user changeable inputs			
Total Containers Entering Terminal Gate	**146,214**					
Loaded Containers	**135,714**	78%	12	-	12	5.0
Empty Containers	**10,500**	6%	12	-	12	5.0
Bare Chassis	**13,256**	8%	12	-	12	5.0
Bobtail Tractors	**13,989**	8%	12	-	12	5.0
Total Trips	**173,459**	**100%**				
Entry Gate Transactions						
Entry Gate Transaction	**173,459**		**2**			
Outside Queuing	**173,459**	100%	**5**	-	5	0.2
Trouble Window	**1,735**	**1%**	**30**	30	-	-
Bypass Entrance	**-**	0%	**3**	-	3	0.8
Rail Intermodal Yard Activity						
Pick Up Loaded Container on Chassis	**107,143**	34%	**15**	11	4	1.0
Pick Up Empty Container on Chassis	**35,714**	11%	**15**	11	4	1.0
Locate & Pick Up Bare Chassis	**13,256**	4%	**15**	11	4	1.0
Drop Loaded Container on Chassis	**135,714**	43%	**15**	11	4	1.0
Drop Empty Container on Chassis	**10,500**	3%	**15**	11	4	1.0
Drop Bare Chassis	**13,256**	4%	**15**	11	4	1.0
Chassis Flip/Transfer	**1,429**	1%	**30**	26	4	1.0
Live Lift Container onto Chassis	**-**	0%	**15**	13	2	0.5
Live Lift Container off of Chassis	**-**	0%	**15**	13	2	0.5
Total Transactions	**317,011**	**101%**				
Yard Delay & Repair						
Trouble Window	**4,816**	4%	**30**	-	0	0.1
Equipment Issue	**3,612**	3%	**60**	-	3	1.0
Outbound/Export Containers						
Total Containers Exiting Terminal Gate	**142,857**					
Loaded Containers	**107,143**	62%	12	-	12	5.0
Empty Containers	**35,714**	21%	12	-	12	5.0
Bare Chassis	**13,256**	8%	12	-	12	5.0
Bobtail Tractors	**17,346**	10%	12	-	12	5.0
Total Trips	**173,459**	**100%**				
Exit Gate Transactions						
Exit Gate Transaction	**173,459**	100%	**0**	-	-	-
Inside Queuing	**173,459**	100%	**5**	-	5	0.2
Trouble Window	**1,735**	**1%**	**30**	30	-	0.1
Bypass Exit	**-**	0%	**3**	-	3	0.8
Loaded Subtotal	**242,857**	**70%**	**7,210,156**	**3,235,285**	**3,974,871**	**944,523**
Bobtail/Chassis/Empty Subtotal	**104,060**	**30%**	**2,563,696**	**1,075,622**	**1,488,074**	**423,240**
Off-Dock Rail Terminal Total	**346,917**	**100%**	**9,773,852**	**4,310,907**	**5,462,945**	**1,367,763**

Activity Percentages. This column contains the percentage of all movements through the off-dock rail terminal that are involved in specific activities. Values with tan shading can be replaced by the user.

Activity Durations. This column assigns the appropriate number of minutes to each drayage activity. The cells shaded in tan are defaults based on case studies but may be changed by the user.

Distances. The key input for the over-the-road trips is the distance. As with analogous inputs in other model segments the ideal input value would be a weighted set of distances and volumes. Lacking terminal-by-terminal trip data, the next-best input value would be the distances to rail facilities (if there is more than one) weighted by their relative volumes of port-related activity.

7.4 Inter-Terminal Worksheet

The format of the Inter-Terminal drayage spreadsheet is abbreviated and used differently. Instead of reflecting activity at gates and container yards, this model section represents over-the-road movements between marine terminals. No in-terminal activities are covered.

Inter-Terminal Drayage Mileage & Time

This worksheet reflects time and distance travelled in movements of loaded containers, empty containers, bare chassis, and bobtail tractors between marine container terminals

Activity	Trips	%	Duration (Minutes)	Waiting Time	Travel Time	Distance (Miles)
Inter-Terminal Drayage Trips			= user changeable inputs			
Total Inter-Terminal Container Movements	**5,714**					
Loaded Containers	**5,429**	95%	9	-	9	**4**
Empty Containers	**286**	5%	9	-	9	**4**
Bare Chassis	**-**	0%	9	-	9	**4**
Bobtail Tractors		0%	9	-	9	**4**
Total Trips	**5,714**	**100%**				
Loaded Subtotal	**5,429**	**95%**	**50,030**	**8,329**	**41,701**	**21,714**
Bobtail/Chassis/Empty Subtotal	**286**	**5%**	**2,633**	**438**	**2,195**	**1,143**
Inter-Terminal Total	**5,714**	**100%**	**52,663**	**8,767**	**43,895**	**22,857**

Activity Percentages. There are no user options in this column.

Activity Durations. The durations on this worksheet are calculated from the distances and the average speeds in the duty cycle, and are not user-changeable.

Distances. The key input is the distance between terminals, which has a default value of 4 miles. As in other cases, where there are only two facilities the input value should be the distance between them. In a multi-terminal complex, the ideal input would be the various distances weighted by the number of trips between each pair. The values may be replaced by the user.

7.5 Shipper/Receiver Spreadsheet

Shippers (exporters) and receivers (importers) are the underlying customers for container transportation and in most ports will account for the majority of drayage trips and mileage. This worksheet calculates the over-the-road and on-site mileage and time required to serve those customers.

Shipper & Receiver Drayage Activity

This worksheet reflects movements of loaded containers, empty containers, and bobtail tractors to and from shippers (exporters) and receivers (importers)

Activity	Trips	%	Duration (Minutes)	Waiting Time	Travel Time	Distance (Miles)
Inbound/Import Containers			= user changeable inputs			
Containers Entering Shipper/Receiver Gate	**728,571**					
Loaded Containers	**407,143**	45%	58	-	58	25.0
Empty Containers	**321,429**	35%	58	-	58	25.0
Bobtail Tractors	**182,143**	20%	58	-	58	25.0
Total Trips	**910,714**	**100%**				
Entry Gate Transactions						
Entry Gate Transaction	**910,714**	100%	**2**	2		
Outside Queuing	**910,714**	100%	**3**		3	0.1
Trouble Window	**4,554**	**1%**	**30**	30	-	-
Loading/Unloading						
Pick Up Loaded Container on Chassis	**241,071**	19%	**10**	10	0	0.1
Pick Up Empty Container on Chassis	**305,357**	24%	**10**	10	0	0.1
Drop Loaded Container on Chassis	**305,357**	24%	**10**	10	0	0.1
Drop Empty Container on Chassis	**241,071**	19%	**10**	10	0	0.1
Wait for Container Loading	**80,357**	6%	**60**	60	0	0.1
Wait for Container Unloading	**101,786**	8%	**30**	30	0	0.1
Total Transactions	**1,275,000**	**100%**				
Yard Delay						
Yard Delay	**4,554**	**1%**	**15**	15	-	-
Outbound/Export Containers						
Containers Exiting Shipper/Receiver Gate	**728,571**	80%				
Loaded Containers	**321,429**	35%	58	-	58	25.0
Empty Containers	**407,143**	45%	58	-	58	25.0
Bobtail Tractors	**182,143**	10%	58	-	58	25.0
Total Trips	**910,714**	**100%**				
Exit Gate Transactions						
Exit Gate Transaction	**910,714**	100%	**2**	2		-
Outside Queuing	**910,714**	100%	**3**		3	0.1
Trouble Window	**4,554**	**1%**	**30**	30	-	-
Loaded Subtotal	**728,571**	**40%**	**53,451,905**	**16,034,498**	**37,417,407**	**10,308,964**
Bobtail/Chassis/Empty Subtotal	**1,092,857**	**60%**	**77,893,036**	**21,901,549**	**55,991,486**	**17,303,893**
Shipper/Receiver Total	**1,821,429**	**100%**	**131,344,940**	**37,936,047**	**93,408,893**	**27,612,857**

Activity Percentages. This column contains the percentage of all shipper/consignee movements involved in specific activities, such as dropping an empty container or waiting for an import container to be unloaded. Values with tan shading can be replaced by the user. A key factor is the split between "drop and pick" trips (where the drayman delivers one container and picks up another) and "stay with" trips (where the driver waits while the container is loaded or unload). This factor is addressed on the Secondary Inputs spreadsheet.

Activity Durations. This column assigns the appropriate number of minutes to each drayage activity. The cells shaded in tan are defaults but may be changed by the user.

Distances. The distances on this sheet refer to distances traveled to, from, and within shipper/consignee facilities. The values are derived from the Primary Inputs.

7.6 Container Depot Spreadsheet

The Container Depot spreadsheet uses the same overall format as the other activity sheets but is simpler because only a few of the functions are used.

Container Depot Drayage Activity

This worksheet reflects movements of empty containers, bare chassis, and bobtail tractors to and from off-dock container storage depots

Activity	Trips	%	Duration (Minutes)	Waiting Time	Travel Time	Distance (Miles)
Containers to Depot			= user changeable inputs			
Empty Containers	**14,286**	41%	5	-	5	2.0
Bare Chassis	**13,681**	39%	5	-	5	2.0
Bobtail Tractors	**6,992**	20%	5	-	5	2.0
Total Trips	**34,958**	**100%**				
Entry Gate Transactions						
Entry Gate Transaction	**34,958**	100%	**3**	3	-	-
Outside Queuing	**34,958**		**5**	-	5	0.2
Trouble Window	**1,748**	**5%**	**15**	15	-	-
Depot Yard Activity						
Pick up Empty Container on Chassis	**6,840**	16%	**10**	10	0	0.1
Locate & Pick up Bare Chassis		0%	**10**	10	0	0.1
Drop Empty Container on Chassis	**7,143**	17%	**10**	10	0	0.1
Drop Bare Chassis	**13,681**	0%	**10**	10	0	0.1
Chassis Flip		0%	**10**	10	0	0.1
Live Lift Container on Chassis	**6,840**	50%	**15**	15	0	0.1
Live Lift Container off Chassis	**7,143**	50%	**15**	15	0	0.1
Total Transactions	**41,647**	**100%**				
Depot Yard Delays						
Trouble Window	**2,082**	**0**	**30**	-	-	-
Equipment Issue	**2,082**	**0**	**60**	-	-	-
Containers form Depot						
Empty Containers	**13,681**	39%	5	-	5	2.0
Bare Chassis	**14,286**	41%	5	-	5	2.0
Bobtail Tractors	**6,992**	20%	5	-	5	2.0
Total Trips	**34,958**	**100%**				
Exit Gate Transactions						
Exit Gate Transaction	**34,958**	100%	**3**	-	-	-
Inside Queuing	**34,958**	100%	**3**	-	3	0.1
Trouble Window	**350**	**1%**	**15**	15	-	0.1
Loaded Subtotal	**-**	**0%**	**-**	**-**	**-**	**-**
Bobtail/Chassis/Empty Subtotal	**69,916**	**100%**	**1,644,057**	**1,250,364**	**393,694**	**127,334**
Container Depot Total	**69,916**	**100%**	**1,644,057**	**1,250,364**	**393,694**	**127,334**

Activity Percentages. This column contains the percentage of all movements through the container depot involved in specific activities, such as dropping a container for storage. Values with tan shading can be replaced by the user.

Activity Durations. This column assigns the appropriate number of minutes to each drayage activity. The cells shaded in tan are defaults but may be changed by the user.

Distances. The distances on this sheet refer to distances traveled to, from, and within off-dock container depots. The values are derived from the Primary Inputs.

7.7 Crosstown Trips Worksheet

The crosstown trips spreadsheet is provided to account for categories of "crosstown" drayage trips that do not involve port facilities.

Crosstown Drayage Activity

This worksheet reflects ancillary movements of empty containers, bare chassis, and bobtail tractors between non-port facilities

Activity	Trips	%	Duration (Minutes)	Waiting Time	Travel Time	Distance (Miles)
Inbound/Import Containers			= user changeable inputs			
Empty Containers	**10,000**	5%	23	-	23	10.0
Bare Chassis	**-**	0%	23	-	23	10.0
Bobtail Tractors	**203,123**	95%	23	-	23	10.0
Total Trips	**213,123**	**100%**				
Drayage Yard Activity						
Pick up Empty Container on Chassis	**8,286**	45%	**15**	15	-	-
Drop Empty Container on Chassis	**10,000**	55%	**15**	15	-	-
Total Transactions	**18,286**	**100%**				
Yard Delay & Repair						
Yard Delay	**1,829**	10%	**30**	30	0	0.1
Equipment Repair	**914**	5%	**30**	30	4	1.0
Outbound/Export Containers						
Empty Containers	**8,286**	4%	23	-	23	10.0
Bare Chassis	**-**	0%	23	-	23	10.0
Bobtail Tractors	**206,480**	96%	23	-	23	10.0
Total Trips	**214,766**	**100%**				
Loaded Subtotal		**0%**	**-**	**-**	**-**	**-**
Bobtail/Chassis/Empty Subtotal	**427,889**	**100%**	**10,219,578**	**1,997,840**	**8,221,738**	**4,280,035**
Crosstown DrayageTotal	**427,889**	**100%**	**10,219,578**	**1,997,840**	**8,221,738**	**4,280,035**

Activity Percentages. This column contains the percentage of different cross-town trip activities. The only relevant proportions are those of loads, empties, and bobtails. Values with tan shading can be replaced by the user.

Activity Durations. This column assigns the appropriate number of minutes to each drayage activity. The travel times are calculated by the model based on average speeds across the duty cycle. The waiting times can be changed by the user.

Distances. The distances on this sheet refer to distances traveled between non-port facilities (e.g. between rail terminals and container depots). The distances are linked to the Primary Inputs.

7.8 Other Port Trucks Worksheet

This worksheet is provided to account for movements of non-container port trucks, such as those moving bulk or break-bulk cargoes. The format of this worksheet is simpler than the others. The default model does not include such trips, so all such data must be added by the user.

Other Port Truck Activity

This worksheet reflects movements of non-container trucks or other movements not covered in other worksheets

Activity	Trips	%	Duration (Minutes)	Waiting Time	Travel Time	Distance (Miles)
Inbound/Import Trips			= user changeable inputs			
Loaded Trucks	-	0%	58	-	58	25.0
Empty Trucks	-	0%	58	-	58	25.0
Bobtail	-	0%	23	-	23	**10**
Total Trips	-	**0%**				
Entry Gate Transactions						
Entry Gate Transaction	-	99%	**1**	1	-	-
Outside Queuing	-		**2**	-	2	0.1
Trouble Window	-	**1%**	**30**	30	-	-
Yard Activity						
Loading	-	0%	**60**	59	1	**0.2**
Unloading	-	0%	**30**	29	1	**0.2**
Total Transactions	-	**0%**				
Yard Delay & Repair						
Yard Delay	-	**1%**	**15**	15	-	-
Outbound/Export Trips						
Loaded Trucks	-	0%	58	-	58	25.0
Empty Trucks	-	0%	58	-	58	25.0
Bobtail	-	0%	23	-	23	**10**
Total Trips	-	**0%**				
Exit Gate Transactions						
Exit Gate Transaction	-	99%	**1**	1	-	-
Inside Queuing	-		**2**	-	2	0.1
Trouble Window	-	**1%**	**30**	30	-	-
Loaded Subtotal	-	**0%**	-	-	-	-
Bobtail/Empty Subtotal	-	**0%**	-	-	-	-
Other Port Trucks Total	-	**0%**	-	-	-	-

Activity Percentages. This column contains the percentage of non-container truck movements by activity type. Values with tan shading can be replaced by the user.

Activity Durations. This column assigns the appropriate number of minutes to each drayage activity. Travel times are calculated by the model; waiting times can reflect user inputs.

Distances. The distances on this sheet refer to distances traveled by non-container trucks to and from port facilities and are linked to the Secondary Inputs worksheet. The tan values may be replaced by the user.

7.9 Resetting Base Case Default Outputs

Once any default detailed input values have been replaced by more specific, local data, the default output values must be reset accordingly.

To reset the default output values, click the New Default From Scenario button on the Primary Inputs and Outputs worksheet. At this point the model provides a new base case estimate of drayage activities, costs, and emissions for the port or terminal being modeled. This base case then becomes the new default against which new scenarios can be compared. (To restore the generic defaults, use the Restore Generic Defaults button.)

8.0 Troubleshooting

8.1 Problem Types

The user may encounter problems of several different types, some of which are model issues, some data issues, and some Excel issues. Each type is discussed separately below.

8.2 Model and Data Issues

The model itself has been tested by multiple users across a wide variety of circumstances. It is possible, however, that users may encounter a problem with the model due to a combination of actions that did not occur or cause trouble in testing.

The user may also encounter problems after inputting scenario values outside the expected range.

Using the Container Distribution worksheet. The core of the activity model is the Container Distribution worksheet. This worksheet draws on the volume and distribution information from the input sheet to allocate flows of loaded containers, empty containers, bare chassis, and bobtail tractors among the various activity centers. The spreadsheet can also be used to troubleshoot apparent model errors or inaccuracies.

DrayFLEET Port Container Distribution Worksheet

Note: For clarity and consistency, all directions are Port orientation. Inbound=Import, Outbound=Export

Marine Container Terminals		
To/From Vessels	**Number**	**%**
Annual Port TEU	2,000,000	na
Equiv. Containers	1,142,857	100%
IB/Import Loads	542,857	48%
IB/Import Empties	28,571	3%
OB/Export Loads	428,571	38%
OB/Export Empties	142,857	13%

Non-gate Container Moves		
	On-Dock Barge Transhipment	**On-Dock Rail**
	Port Share 0%	**Port Share 0%**
	-	-
	-	-
	Number	**Number**
IB/Import Loads	-	-
IB/Import Empties	-	-
OB/Export Loads	-	-
OB/Export Empties	-	-

Terminal Gate Moves	
Outgate Loads	548,286
Outgate Empties	331,786
Outgate Chassis	25,672
Outgate Bobtails	388,176
Other Outgate Trucks	-
Outgate Subtotal	**1,293,919**
Ingate Loads	**432,857**
Ingate Empties	**448,324**
Ingate Chassis	27,541
Ingate Bobtails	385,197
Other Ingate Trucks	-
Ingate Subtotal	**1,293,919**
Net Port Container Gain/Loss	1,109
Terminal Gate Total	**2,587,839**

Marine Terminal Trips	
Outgate 717,214	→
Ingate 718,929	←
Outgate 5,714	→
Ingate 5,714	←
Outgate 154,849	→
Ingate 156,113	←
Outgate 27,966	→
Ingate 27,966	←
Outgate 0	→
Ingate 0	←

Containers & Chassis Handled			
Shipper/Receiver Trips			
Port Share 75%	**Number**	Bobtails to S/Rs	182,143
IB/Import Loads	407,143	Bobtails from S/Rs	182,143
IB/Import Empties	321,429	Empties to Rail	3,214
OB/Export Loads	321,429	Empties from Rail	4,071
OB/Export Empties	407,143	Empties to Depot	3,214
		Empties from Depot	4,071
		Import Ctrs Reused	3,214
Inter-Terminal Drayage Trips			
Port Share 1%	**Number**		
IB/Import Loads	5,429		
IB/Import Empties	286		
IB/Import Chassis	-		
OB/Export Loads	4,286		
OB/Export Empties	1,429		
OB/Export Chassis	-		
Off-Dock Rail Intermodal Trips			
Port Share 25%	**Number**	Bobtails to Rail	13,989
IB/Import Loads	135,714	Bobtails from Rail	17,346
IB/Import Empties	7,143	Chassis from Depots	-
IB/Import Chassis	11,991	Chassis to Depots	-
OB/Export Loads	107,143	Empties to Depots	357
OB/Export Empties	35,714	Empties from Depots	143
OB/Export Chassis	13,256	Empties to S/R	4,071
		Empties from S/R	3,214
Off-Dock Container Depot Trips			
IB/Import Loads	0	Bobtails to Depots	6,992
IB/Import Empties	14,286	Bobtails from Depots	6,992
IB/Import Chassis	13,681	Chassis from Rail	
OB/Export Loads	0	Chassis to rail	
OB/Export Empties	13,681	Empties from Rail & S/R	3,571
OB/Export Chassis	14,286	Empties to Rail & S/R	4,176
Other Port Truck Trips			
IB/Import Loads	0	Inbound Bobtails	-
IB/Import Empties	-	Outbound Bobtails	-
OB/Export Loads	0		
OB/Export Empties	-		
Total Terminal + Crosstown Trips	**3,008,904**	**Crosstown Total**	**421,066**

This spreadsheet functions as a check on the logic and completeness of the scenario inputs. The container distribution chart is driven by entries elsewhere, total TEU and proportional splits between activity and customer groups. There are no user entries on this worksheet.

- If the flows shown on the chart do not appear correct it is an indication of problems with input factors either on the primary input sheet or on one of the activity center sheets.

- If the overall container count is wrong either the TEU total, the inbound/outbound balance, the load/balance, and the containers per TEU conversion factors should be checked.

- If the barge or on-dock rail volumes appear wrong, the barge percentage, the rail percentage, and the on-dock rail shares should be checked.

If the totals and proportions in the marine terminal gate section of the flow chart do not agree with empirical data, the following issues should be considered. (other than inaccuracy of the data).

- Proportions and volumes of containers moved via barge or on-dock rail. In particular, the load/empty balances of barge or rail flows may differ significantly from the overall port balance. (see the Secondary Inputs worksheet)

- Proportions of bobtail or bare chassis moves (on the Marine Terminal activity center sheet). There may be local reasons for higher or lower percentages of bobtail or bare chassis moves, such as off-terminal or storage, a higher number of inter-terminal moves. (see the Secondary Inputs worksheet)

- The existence of bypass gates, inter-terminal or depot moves by yard tractors, or other reasons why some moves are not reflected in terminal gate counts. (see the Secondary Inputs worksheet)

- A mismatch between the pattern reflected in gate counts and the overall annual port drayage pattern. This mismatch might occur if a monthly or weekly sample includes non-typical activity such as service disruptions or large-scale equipment repositioning.

The marine terminal gate flow numbers on the flow chart are matched on the marine terminal activity center sheet. The relationships on that sheet should be reviewed in detail if the flow chart numbers appear incorrect.

8.3 Error Messages

The Excel **#DIV/0!** message may appear if the user inserts zero into a cell where zero is not a valid value, such as in the Annual TEU or Avg./TEU Container fields.

The Excel **#VALUE!** message usually indicates that the user has entered a non-numerical character in a numerical field, such as inputting the letter “a” for the Outbound Empty %.

The Excel **Circular Reference** error message may appear if the user inadvertently sets a default value equal to the corresponding scenario value, since the scenario value is ordinarily equal to the default already.

8.4 Problems with Excel Functionality

Correct model functioning depends on numerous Excel functions and features, including several macros. Where difficulties with the model are traceable to Excel itself, standard software troubleshooting procedures apply. Suggestions include:

- Consulting the Excel Help file (keyboard shortcut F1).
- Using the Formula Auditing tools under Tools on the Excel standard toolbar.
- Using the "Detect and Repair" under Help on the Excel standard toolbar.
- Using the Open and Repair option when opening the model file.
- Entering a brief description of the problem into an Internet search engine (e.g. Google).